

**OFFICE OF OVERSIGHT
REVIEW OF NUCLEAR CRITICALITY SAFETY**

**FIELD REPORT
FOR THE OAK RIDGE Y-12 PLANT
BUILDINGS 9212 AND 9818**



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**Office of Oversight
Environment, Safety and Health
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ACRONYMS

ANS	American Nuclear Society
ANSI	American National Standards Institute
CSE	Criticality Safety Evaluation
DOE	Department of Energy
EH	Office of Environment, Safety and Health
LMES	Lockheed Martin Energy Systems
NCS	Nuclear Criticality Safety
OR	Oak Ridge Operations Office
YSO	DOE Y-12 Site Office

OFFICE OF OVERSIGHT TERMINOLOGY

Noteworthy Practice: An innovative approach or practice related to environment, safety, and health systems, programs, processes, or projects that have proven effective in improving safety management systems and performance, and could be a valuable source of information and lessons learned for other DOE sites.

Positive Attribute: A management system, process, or work practice that demonstrates an effective approach, a positive trend/initiative, or a significant improvement over past performance.

Safety Issue: A condition of concern that could have an adverse impact on the environment, safety, or health of the site, its workers, and/or the public. Safety issues require formal resolution and tracking by line management in accordance with DOE Order 414.1A, *Quality Assurance*.

Weakness: A deficiency in a management system, process, or activity that warrants management attention and corrective action but does not require a formal corrective action plan or tracking under the provisions of DOE Order 414.1A.

Opportunity for Improvement: Suggestions offered by the Office of Oversight appraisal team that may assist line management in identifying options and potential solutions to various issues identified during the conduct of the Oversight appraisal.

EXECUTIVE SUMMARY

In November 1999, the Deputy Secretary of Energy directed a series of actions to strengthen Department of Energy (DOE) nuclear criticality safety (NCS) programs. As one of those actions, a team of criticality safety experts from DOE Headquarters and the field conducted a high-level review at the Y-12 Plant and four other DOE sites. The review was led by the Office of Oversight, within the Office of Environment, Safety and Health. The purposes of this review were: (1) to identify any immediate problems and related corrective actions, and (2) to determine whether the operations and criticality safety risks at these facilities are well understood, analyzed, and controlled. The review focused on selected Y-12 Plant facilities (i.e., Buildings 9212 and 9818) that process solutions of fissile materials, because solutions represent the greatest risk of a criticality accident. The Oversight team observed field implementation of selected operations but did not perform a comprehensive review of implementation of requirements.

Although timely improvements are needed, the Oversight team did not identify any conditions that presented an immediate risk of a criticality accident involving fissile solutions at the Y-12 Plant facilities that were reviewed. The contractor NCS program is well designed and thoroughly documented, and the DOE Oak Ridge Operations Office and DOE Y-12 Site Office have been active in monitoring and evaluating contractor performance.

No imminent hazards were identified, but the Oversight team identified two safety issues—areas where provisions of DOE orders and national consensus criticality standards were not met—at the Y-12 Plant. One issue involves inadequate control of movements of fissile nuclear materials, and the other involves insufficient site reviews of operations to ensure compliance with NCS requirements. These two issues require a formal corrective action plan in accordance with DOE Order 414.1A, *Quality Assurance*. Other identified weaknesses were less significant but still warrant management attention and corrective actions. For example, some NCS requirements were complicated and confusing, and operators did not have sufficient involvement in developing controls to understand their technical basis.

Overall, the Y-12 Plant has a well documented program and has identified appropriate controls. However, the implementation of the NCS program by the operating division at the Y-12 Plant needs increased attention and timely improvement. Table ES-1 summarizes the identified safety issues and opportunities for improvement.

Table ES-1. Summary of Safety Issues and Opportunities for Improvement

Safety Issues

- Fissile material movement is not controlled in such a way as to provide assurance that movements to and from workstations and storage locations comply with established NCS controls as required by Section 9 of ANSI/ANS-8.19.
- Operations are not reviewed at least annually as required by Section 7.8 of ANSI/ANS-8.19 to verify that procedures are being followed and that process conditions have not been altered so as to affect the applicable NCS evaluation.

Opportunities for Improvement

- Ensure that fissile material movements are controlled to ensure that movements to and from workstations and storage locations comply with established NCS controls.
- Ensure that operations are reviewed at least annually to verify that procedures are being followed and that process conditions have not been altered so as to affect the applicable NCS evaluation.
- Revise the process for developing CSEs to require consideration of credible events and to document process and system assumptions.
- Ensure that NCS requirements are clear and easy to understand and implement.
- Involve operators in the NCS program and ensure ownership and understanding of the controls.
- Enhance processes for continuous improvement and feedback.
- Ensure that the facility configuration and process descriptions are documented and controlled in stand-alone documents.

OFFICE OF OVERSIGHT REVIEW OF NUCLEAR CRITICALITY SAFETY FIELD REPORT FOR THE OAK RIDGE Y-12 PLANT BUILDINGS 9212 AND 9818

1.0 INTRODUCTION

The Department of Energy (DOE) Office of Oversight, within the DOE Office of Environment, Safety and Health (EH), conducted a review of selected aspects of the nuclear criticality safety (NCS) program at the Y-12 Plant Buildings 9212 and 9818. The Oversight review of the Y-12 Plant was one portion of a broader DOE initiative to improve nuclear criticality safety, as directed by the Deputy Secretary of Energy in his November 3, 1999, memorandum entitled “Nuclear Criticality Self-Improvement Initiative.” One of the provisions of the Deputy Secretary’s memorandum was a review of key facilities at five sites (the other sites were the Los Alamos National Laboratory, the Hanford Plutonium Finishing Plant, the Savannah River Site, and the Rocky Flats Environmental Technology Site) by a team of criticality safety experts led by the EH Office of Oversight.

The site review was conducted in two stages. The first stage, on November 15-18, 1999, focused on the four program areas discussed below. The second stage took place on December 16, 1999, and focused on the implementation of proper conduct of operations that affect NCS in Building 9212. The second assessment was performed at the request of the DOE Office of Defense Programs in response to the discovery of several NCS deficiencies and subsequent stand-down of fissile material operations at Y-12. The eight-person Oversight review team was composed of NCS experts from DOE Headquarters and field offices. Appendix A provides additional information on the composition of the review team.

Consistent with the direction provided by the Deputy Secretary, the purpose of this review is twofold: (1) to identify any immediate problems and related corrective actions, and (2) to assess whether the operations and criticality safety risks at these facilities are well understood, analyzed, and controlled. The Oversight team focused on four key nuclear criticality safety program elements as applied to selected fissile material operations.

The four key nuclear criticality safety elements reviewed were: criticality safety evaluations and controls, work control, change control, and line management oversight. The criteria for each of these areas were provided by the Deputy Secretary and were derived from the national consensus standard American National Standards Institute (ANSI)/American Nuclear Society (ANS)-8.19, which is required by DOE Order 420.1, *Facility Safety*, and from DOE Policy 450.5, *Line Environment, Safety and Health Oversight*. Appendix B presents the evaluation criteria for the four criticality safety elements.

The Y-12 Plant facilities that were reviewed included Building 9212 and Building 9818. Fissile nuclear materials operations at these facilities involve processing, handling, and storage of solutions of fissile materials. Criticality accidents typically involve safety management system breakdowns impacting fissile solution processing. Of the 22 known criticality accidents involving fissile material processing, 21 have involved solutions, including the most recently publicized accident in Tokaimura, Japan.

The common causes of criticality accidents to date have been failure to perform a criticality safety evaluation (CSE) for a process; undetected process and system changes; failure to develop, review, and approve operating procedures; absence of effective worker training; and failure to conform to established procedures and limits. No criticality accident has occurred as a result of a faulty calculation of reactivity, and no known criticality accident has involved storage or transport of fissile material.

The NCS review of the Y-12 Plant Buildings 9212 and 9818 was conducted according to Oversight protocols and procedures, including the validation of data throughout all stages of the process. The Oversight review included tours of fissile solution handling and processing operations. The review team interviewed DOE Oak Ridge Operations Office (OR), OR Y-12 Site Office (YSO), and Lockheed Martin Energy Systems (LMES) personnel, including DOE Facility Representatives and contractor personnel with responsibility for NCS, audits and assessments, work planning and control, configuration management, and authorization basis. The Oversight team reviewed a representative sample of operational criticality safety controls (e.g., criticality safety limits summarized in postings and stated in operating procedures), work controls (e.g., other procedural and administrative controls governing normal work tasks, including maintenance, that affect criticality safety), change controls, and audit/self-assessment practices. Selected CSEs and other documents that form the basis for these controls and practices were also reviewed.

This Oversight review focused exclusively on criticality safety aspects of Buildings 9212 and 9818. Consequently, the review does not constitute an assessment of the overall NCS program in relation to the requirements of the ANSI/ANS standards and DOE Order 420.1, *Facility Safety*. The elements of ANSI/ANS Standard 8.19 were applied to only those specific processes selected for review. Further, the Oversight team had only limited opportunity to observe actual work in progress during the field visit because the review was conducted according to an accelerated schedule and because few operations were ongoing during the period of the review. The review therefore focused primarily on interviews, documentation, records, and facility tours.

2.0 RESULTS

The Oversight team noted one positive attribute, two safety issues, and five weaknesses in the application of specific elements of the requirements.

2.1 Positive Attributes

1. DOE OR/YSO personnel are actively involved in oversight of the NCS program.

The OR/YSO NCS Program Manager conducts periodic NCS program assessments, maintains awareness of contractor operations and the status of NCS issues, and interacts with contractor and OR/YSO personnel to ensure that NCS issues are identified and addressed. OR/YSO Facility Representatives are knowledgeable of activities in Buildings 9212 and 9818. The OR/YSO Y-12 NCS Program Manager works and communicates well with the Facility Representatives. The OR/YSO NCS Program Manager develops performance metrics for NCS and monitors progress on a regular basis. In addition to reviewing contractor self-assessments, OR/YSO currently uses two metrics to assess performance: performance analysis upgrades and out-of-specification containers. OR/YSO plans to implement additional metrics similar to those recently promulgated by EH and integrate these performance measures into the contract over time. The OR/YSO NCS Program Manager and Facility Representatives are frequently in the work areas assessing compliance with NCS requirements.

2.2 Safety Issues

The following two safety issues require a formal response in accordance with DOE Order 414.1A, *Quality Assurance*. The corresponding corrective actions will be tracked in the DOE Corrective Action Tracking System (CATS).

1. Fissile material movement is not controlled in such a way as to provide assurance that movements to and from workstations and storage locations comply with established NCS controls as required by Section 9 of ANSI/ANS-8.19.

The numerous recent NCS deficiencies related to fissile material storage and handling are the symptom of non-conformance with DOE Order 420.1 and the mandatory standards ANSI/ANS-8.1 and 8.19 as they pertain to material control. Fissile materials are not tracked by specific location, making it hard for operators to correctly locate and identify

materials for movement. In addition, movement of fissile material is not planned in such a way as to establish compliance with NCS controls before, during, and after the move. Operators are allowed to begin movement of materials without identifying specific destinations for the material. The work planning process does not ensure that the material will be in conformance with established NCS controls after the movement is completed. There is no record of the exact location of the fissile material after the move is completed.

In the area of fissile material movements as well as other fissile material operations, work planning lacks the depth and breadth necessary to ensure compliance with all NCS controls that might be encountered during the task. Operators rely on supervisors to define the work such that the work is in compliance with established requirements. Operations supervision is not performing the advance planning necessary to identify all job tasks and to ensure compliance with applicable criticality safety requirements during the entire process. Operators are not made aware of all the criticality safety requirements that might affect execution of the task. The Oversight team determined that the prejob brief checklist is narrow in scope, and the pre-job briefs are too narrowly focused and do not cover all the specific criticality safety limits and controls involved in the task. Even though criticality safety requirements are highlighted in procedures, in some cases they are not fully implemented (understood and executed) in operations. Criticality controls, identified as criticality safety requirements in the CSEs, are included in operating procedures, and the criticality controls are clearly identified as important to safety. These criticality safety requirements are referenced in the procedures by bold type and delineated with “carets” (i.e., “<>”). Although the paperwork is exemplary in translating CSE-derived controls to procedures, recent events at Y-12 indicate that actual process line implementation is weak.

2. Operations are not reviewed at least annually as required by Section 7.8 of ANSI/ANS-8.19 to verify that procedures are being followed and that process conditions have not been altered so as to affect the applicable NCS evaluation.

The numerous recent NCS deficiencies involving incorrectly stored fissile material are indicative of this non-conformance with DOE Order 420.1 and the mandatory standards ANSI/ANS-8.1 and 8.19 as they pertain to operational reviews. Several of the deficiencies are legacy issues that should have been detected if operations in the work area were being reviewed frequently (at least annually) as required. There is a program for ensuring that only current procedures and criticality safety requirements are in place on an annual basis. However, the program is flawed in two important ways. First, the annual review requirement is a rolling requirement that changes with each revision to the procedure or the criticality safety requirement. With the many revisions taking place in preparation for Enriched Uranium Operations restart, even the paper reviews are not occurring on an annual basis. Second, Operations does not have an audit process in place to verify that the fissile material, equipment, and processes in the work area comply with established NCS controls. Therefore, there is no method to systematically cover all operations on at least an annual basis to ensure compliance with NCS controls and to ensure that process conditions have not been altered so as to affect the applicable CSE.

2.3 Weaknesses

Although not requiring a separate, formal response in accordance with DOE Order 414.1A, the following weaknesses warrant management attention and appropriate corrective actions. In discussions with the Office of Oversight, the site has agreed to include these weaknesses in their site self-assessment, which is a required element under the Deputy Secretary's NCS self-improvement initiative. The sites will track the weakness and corresponding corrective actions in site-level corrective action tracking systems.

1. The process for developing criticality safety evaluations does not produce complete, fully documented criticality safety analyses.

Although the risk of a criticality accident resulting from a natural phenomena hazard event is remote, such events are not analyzed or controlled in Enriched Uranium Operations as potential initiators of criticality accidents. Documents supporting this conclusion are Y70-150 and Y74-802 “Authorization Basis Documents for Nuclear PSM/RMP” and Specified Chemically Hazardous Facilities.” Interviews with DOE/LMES Safety Analysis personnel indicated that realistic modeling of natural phenomena events is lacking in the Building 9212 basis for interim operations document, resulting in the absence of mitigative features and controls to preclude credible NCS events in the CSEs.

LMES is preparing a revised Authorization Basis Implementation Plan. Discussions with LMES management responsible for revising the Authorization Basis Implementation Plan and the Nuclear Criticality Safety Division manager indicate their understanding of the interrelationship between the authorization basis and CSE process. As scenarios are developed for less-than-design-basis seismic events by authorization basis staff, the NCS staff will use those scenarios in CSEs to develop controls. Both managers committed to explicitly including NCS analysis and CSE revisions, as appropriate, in the revised Authorization Basis Implementation Plan. Discussions with LMES personnel indicate that the revised program plan will address criticality safety concerns if it is adequately funded and implemented.

Not all assumptions were fully documented in each CSE. The team noted an example in which bounding assumptions were not always included in evaluations. Specifically, the Organic Treatment System evaluation does not discuss the possibility that a limited fire could concentrate the uranium to a much higher concentration than that assumed. Currently, this accident scenario is incredible, because there is no source of air in this system. However, the evaluation does not currently list this bounding assumption to remind criticality safety engineers to verify that no changes had been made in the process that could invalidate the underlying assumption. Interviews and document reviews revealed that LMES has recently revised the format of CSEs to ensure that all bounding assumptions will be fully documented.

2. Some NCS requirements are complicated and confusing.

There are over one hundred different containers in use at Y-12 and multitudes of storage options for these containers. The limits for the containers and general handling and storage are contained in the "7270" and "103" procedures, respectively. These two procedures are referenced by many NCS postings because it would be too cumbersome to include all the information on individual postings. Neither "7270" nor "103" is readily available to operators when doing work. Many of the containers are physically similar but have different NCS controls, and there are storage arrangements that appear similar to the operator but have different requirements. All this leads to confusion on the part of operators trying to use limits that only refer to the "7270" and "103" procedures.

Some postings were obscured or were otherwise hard to read. For example, one posting used a small typeface, and was thus hard to read, because it contained many limits and was developed as part of Phase A Restart. Interviews revealed that there is a reluctance to use multiple-page postings, even though existing guidance allows that. Some other postings were partially obscured by other items in front of them. Interviews revealed that obscured or otherwise hard to see postings constitute an ongoing problem at Y-12. Also, some earlier postings have not been upgraded to reflect recently issued guidance on posting content and minimum print size, which is adequate and is being used to develop postings for Phase B operations. However, the Manager of Criticality Safety indicated that he is working on corrective actions to minimize problems with earlier postings. For example, LMES has added a review of postings to the process analysis upgrade program and has already begun a review of posting for usability and to determine conformance with the new guidance document.

There is no site-specific guidance on what controls must be posted. However, all necessary controls were found in the respective procedures. Interviews with the process engineers and criticality safety analysts revealed that the operations staff is trained to rely on the controls as stated in the approved procedures. They see the postings as operational **aids**, as the ANSI/ANS 8.19 standard intends. Postings supplement procedures, so it is not necessary to post all controls. Personnel who were interviewed indicated that Y-12 was taking corrective actions to make postings more consistent.

3. Operators are not consistently involved in the NCS program and lack ownership and understanding of the controls.

Interviews with operators indicated that they were not fully aware of the contingencies and assumptions used to generate CSEs. Operators are not consistently involved in developing contingencies and controls during the CSE development process. Several operators expressed frustration at not being told why NCS limits had been reduced from levels they had used in operating processes for many years. Operators do not have input into the format and content of the postings they are required to follow and expressed frustration that their suggestions for improvement are not implemented. Furthermore, fissile material handler training on limits/controls is deficient in explaining the rationale behind the

criticality safety limits that are used on the floor. The recently-established "Small Group Seminars" may help the operators understand the basis for the limits/controls they are required to implement.

4. Processes for continuous improvement and feedback are not effective.

There is no process for dealing with procedure/posting discrepancies in an appropriately graded fashion. Unwarranted emphasis has been placed on the exactness of *recommended supplemental* postings. Because of this over-emphasis, processes have been shut down due to minor (typographical) differences between criticality safety requirements in procedures and criticality safety requirements in the associated posting.

There is no institutional funding for the Y-12 Plant Criticality Safety Committee; the Committee has lost significant expertise, and there is no clear plan to add additional expertise. Contractor management is using its Y-12 Plant Criticality Safety Committee to support its criticality safety program. The Committee is chartered and used in the following three areas: to conduct an annual review of the Y-12 criticality safety program; to conduct Level 3 criticality safety incident investigations; and to review proposed criticality safety policy and make recommendations to plant management. Although the Committee is currently chartered and functional, there is concern over its continued effectiveness because no funding was allocated in FY 2000 to support Committee activities and its membership has diminished from five to two individuals. Additionally, management does not provide the institutional funding necessary to bring in outside experts periodically to add a valuable external perspective to these reviews. The Committee tracks corrective actions through completion; however, in some cases, depending on priorities, resources are not adequate to complete corrective actions in a timely manner.

5. The facility configuration and process descriptions are not documented and controlled in stand-alone documents.

Not all Phase A Restart CSEs contain system/process descriptions. However, LMES has committed to including process descriptions for all Phase B Restart CSEs as part of lessons learned. All Phase B process descriptions that were reviewed appeared to be adequate. At one point during Phase A evaluations a decision was made not to spend time developing process descriptions as part of the CSEs for organic handling. The result was that the criticality safety analysts had an incomplete understanding of what could be expected during actual operations. There was therefore a misunderstanding of terminology in the report that resulted in the criticality safety analyst requesting to halt the process during first-use validation when she observed something that did not agree with her understanding of the CSE. Since that time, however, there has been a renewed effort to include process descriptions as part of the CSE. Interviews with process engineers and their criticality safety analyst counterparts show that the analyst now have a better understanding of the process, and the process engineer understands what is being evaluated as part of the CSE. The current practice of utilizing a section of the criticality safety evaluation as a configuration control document for the process description is not effective or efficient. Line management should bear the responsibility for defining and maintaining the facility and process configuration, not the Nuclear Criticality Safety Division. This practice could cause unnecessary unreviewed safety questions because deviations from the process described in the CSE results in an erroneous safety basis, regardless of how insignificant the impact of the deviation is on safety. The information in the process descriptions provides valuable information to a number of organizations and should be a stand-alone document developed and maintained by Operations. Furthermore, LMES is currently working on grading of the configuration control approval authority for equipment.

3.0 CONCLUSIONS AND OPPORTUNITIES FOR IMPROVEMENT

Based on the Oversight review, there are no imminent criticality safety hazards at the Y-12 Plant facilities reviewed. The NCS program elements that were reviewed (i.e., criticality safety evaluations and controls, work control, change control, and line management oversight) are in place and provide assurance that the criticality safety risks at these two Y-12 Plant facilities are properly controlled.

Although there are safety issues and several weaknesses, the NCS program is well designed and thoroughly documented. The program contains all the elements needed to identify, analyze, and control criticality hazards if implemented as

currently developed for Enriched Uranium Operations restart. However, increased management attention and timely action to improve operational implementation of the NCS program are needed.

Although not reviewed in detail as part of this effort, the Oversight team also determined that deactivation and decommissioning of Building 9206 will require increased attention to ensure effective implementation of integrated safety management with a full appreciation of the uncertainty in the characterization of the hazards in that facility. The facility has been shut down for a substantial period of time, and personnel experienced with past operations are scarce. EH reviewed the criticality safety aspects of the operations in Building 9206 in 1998 ("First-Quarter Criticality Safety Program Review at the Oak Ridge Y-12 Plant", DOE-EH-0561) and found them to be adequately controlled as long as the facility remained in its current mode. LMES has plans in place for the decontamination and decommissioning of Building 9206, but these have not yet been funded. Although current OR/YSO line management oversight of Building 9206 is adequate, OR/YSO personnel acknowledged that line management oversight of Building 9206 must increase as decontamination and decommissioning activities commence.

Two issues that require a formal corrective action plan, and five other weaknesses in the application of specific elements of the requirements, were identified. The following opportunities for improvement should be considered to address the identified weaknesses.

1. Ensure that fissile material movements are controlled to ensure that movements to and from workstations and storage locations comply with established NCS controls (see Issue #1).

- Establish a baseline of fissile material compliance with current requirements.
- Ensure that pre-job briefs cover all the specific criticality safety limits and controls involved in the task.
- Ensure that tasks are pre-planned, scripted, and briefed in detail before sending operators into the area to perform work.
- Maintain current records of fissile material locations.

2. Ensure that operations are reviewed at least annually to verify that procedures are being followed and that process conditions have not been altered so as to affect the applicable NCS evaluation (see Issue #2).

- Develop a schedule for operations criticality safety assessments/audits that ensures that 100 percent of all items and workstations are examined for compliance with established NCS controls at least annually.
- Ensure that criticality safety engineers frequent the work areas, informally discuss the processes and NCS controls with operators, solicit suggestions for improvements, and assist operators in conducting work area audits.

3. Revise the process for developing CSEs to require consideration of credible events and to document process and system assumptions. (see Weakness #1).

- Ensure that natural phenomena hazards scenarios are developed for less-than-design-basis seismic events and incorporated into the CSEs, and that appropriate controls are developed.
- Ensure that CSEs document all bounding assumptions affecting criticality safety.

4. Ensure that NCS requirements are clear and easy to understand and implement (see Weakness #2).

- Develop site-specific guidance on what controls must be posted.
- Review NCS postings to ensure that they can be read at the workstation and understood by operators.

- Clarify and simplify the "7270" and "103" documents and the implementation of their requirements, using input from an integrated operator-Nuclear Criticality Safety Division-Process Engineering team.

5. Involve operators in the NCS program and ensure ownership and understanding of the controls (see Weakness #3).

- Ensure that operators participate in the development of contingencies, controls, and postings.
- Implement the criticality safety officer position using best practices from Los Alamos, Rocky Flats, and the Hanford Plutonium Finishing Plant.
- Appoint two or more full time, dedicated criticality safety officers to provide coverage for Buildings 9206 and 9212.
- Assign responsibility for preparation of NCS postings to the criticality safety officers.
- Provide mentoring for newly appointed criticality safety officers.
- Identify opportunities for Operations to correct trivial NCS deficiencies.
- Increase opportunities for senior operators to mentor less-experienced operators.

6. Enhance process for continuous improvement and feedback (see Weakness #4).

- Develop a process for dealing with minor procedure/posting discrepancies.
- Provide resources for the Y-12 Plant Criticality Safety Committee.
- Add additional expertise to the Y-12 Plant Criticality Safety Committee and establish a succession plan to ensure continuity of expertise and corporate memory.
- Implement feedback and improvement processes that promote bottom-up solutions and initiatives.
- Facilitate continuous improvement and communication of best practices as they relate to the implementation of the small group seminars.

7. Ensure that the facility configuration and process descriptions are documented and controlled in stand-alone documents (see Weakness #5).

- Document and control process descriptions and facility configurations in stand-alone documents independent of the CSEs.

APPENDIX A

TEAM COMPOSITION

The team membership, composition, and responsibilities are as follows:

Deputy Assistant Secretary for Oversight

S. David Stadler, Ph.D.

Associate Deputy Assistant Secretary for Oversight

Raymond Hardwick

Team Leader

Jerry McKamy, Ph.D.

Management Advisor to the Team

Ed Blackwood

Line Management Oversight Subgroup

Adolf Garcia
Jim Felty

Work and Change Control Subgroup

Bill Weaver
Gypsy Tweed

Criticality Safety Evaluations and Controls Subgroup

Steve Payne, Ph.D.
Ivon Fergus

Communications and Support

Cynthia D. Dorsey

Quality Review Board

Frank Russo
Ray Hardwick
Thomas Staker
Thomas Davis

APPENDIX B

EVALUATION CRITERIA

INTRODUCTION

This appendix presents the evaluation criteria used in this Oversight review. It also presents the lines of inquiry (i.e., the specific areas of focus within each criterion) that correspond to each of the criteria. The criteria and lines of inquiry are presented for each of the four safety management areas reviewed by Oversight:

1. Criticality safety evaluations and controls
2. Work control
3. Change control
4. Line-management oversight.

Most of the evaluation criteria and lines of inquiry (i.e., criteria 1.1 through 4.4) for this Oversight review apply primarily to the contractors that implement NCS programs at DOE sites. These criteria and lines of inquiry were derived from the consensus standard ANSI/ANS-8.19, which is established as a DOE requirement by provisions of DOE Order 420.1.

Certain criteria (i.e., criteria 4.5 through 4.10) apply only to the DOE Operations Office and Site Office. The criteria and lines of inquiry that apply to DOE organizational elements were extracted from DOE P 450.5, *Line Environment, Safety and Health Oversight*.

1. CRITICALITY SAFETY EVALUATION AND CONTROLS

1.1 Criterion: Before starting a new operation with fissile materials or before an existing operation is changed, it shall be determined that the entire process will be subcritical under both normal and credible abnormal conditions. (ANSI/ANS-8.19, Section 8.1)

Lines of Inquiry:

- Criticality safety evaluations shall conform to the requirements of ANSI/ANS-8.1, “Nuclear Criticality Safety in Operation with Fissionable Material Outside Reactors.”
- The NCS staff, responsible operations personnel, and responsible support engineering personnel jointly develop contingencies.
- All credible process upsets are considered and are either controlled or dispositioned appropriately. NCS staff familiar with the facility and operations under consideration perform the criticality safety evaluations. The NCS Staff works as a team with operations to develop credible accident scenarios and controls.

1.2 Criterion: The nuclear criticality safety evaluation shall determine and explicitly identify the controlled parameters and their associated limits upon which nuclear criticality safety depends. (ANSI/ANS-8.19, Section 8.2)

Lines of Inquiry:

- Controls are developed in the criticality safety evaluation for each contingency.
- Controlled parameters, contingencies, and credited barriers are explicitly documented.

1.3 Criterion: The nuclear criticality safety evaluation shall be documented with sufficient detail, clarity, and lack of ambiguity to allow independent judgment of results. (ANSI/ANS-8.19, Section 8.3)

Lines of Inquiry:

- 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. The criticality safety evaluations conform to DOE-STD-3007-93, *Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Nuclear Facilities*.
- All assumptions are fully documented in the criticality safety evaluation.
- The criticality safety evaluation can be read and understood by the line supervision.

1.4 Criterion: Before starting operation, there shall be an independent assessment that confirms the adequacy of the nuclear criticality safety evaluation. (ANSI/ANS-8.19, Section 8.4)

Lines of Inquiry:

- All criticality safety evaluations receive an independent technical peer review before approval for use.
- There is 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.

1.5 Criterion: Procedures shall include those controls and limits significant to the nuclear criticality safety of the operation. (ANSI/ANS-8.19, Section 7.2)

Lines of Inquiry:

- Criticality controls are included in operating procedures.
- The criticality controls are clearly identified as important to safety.

1.6 Criterion: Procedures should be supplemented by posted nuclear criticality safety limits or limits incorporated in operating check lists or flow sheets. (ANSI/ANS-8.19, Section 7.6)

Lines of Inquiry:

- Criticality safety postings are easy to understand by operators.
- Postings contain only information controlled by the operator performing the task.
- The relationship of controls in postings to controls in procedures is clear.
- Postings are easy to read from normal operator positions at the workstation.
- Operations personnel and NCS staff validate draft criticality postings and controls prior to implementation.

CHANGE CONTROL PRACTICES

2.1 Criterion: Supervisors shall verify compliance with nuclear criticality safety specifications for new or modified equipment before its use. Verification may be based on inspection reports or other features of the quality control system. (ANSI/ANS-8.19, Section 5.5).

Lines of Inquiry:

- There are procedures or mechanisms in place and effective to ensure that modifications to equipment and/or processes results in a review of the applicable CSEs-procedure-posting set prior to implementing the modification.
- There is a process for ensuring that no new or modified operation is started until all applicable verification steps have been performed which includes presence of approved CSEs, postings, procedures and that no criticality infraction will result from startup.
- A process is in place to verify that as-built equipment and processes conform to the configuration anticipated in the CSE.
- Maintenance work orders that have the potential to impact criticality safety are reviewed by the NCS Staff and a USQD is performed prior to performing the maintenance tasks.

2.2 Criterion: Active procedures shall be reviewed periodically by supervision. (ANSI/ANI-8.19, Section 7.4).

Lines of Inquiry:

- Procedures are periodically reviewed.

- The NCS Staff periodically participate in reviews of active operating procedures.
- The Authorization Basis (SAR, basis for interim operations, etc.) is reviewed periodically by the NCS Staff for changes that potentially impact nuclear criticality safety.

2.3 Criterion: New or revised procedures impacting nuclear criticality safety shall be reviewed by the nuclear criticality safety staff. (ANSI/ANS-8.19, Section 7.5)

Lines of Inquiry:

- New or revised procedures are reviewed by the NCS Staff.
- Proposed changes to the Authorization Basis (SAR, basis for interim operations, etc.) affecting nuclear criticality safety are reviewed by the NCS Staff.

WORK CONTROL PRACTICES

3.1 Criterion: 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. Records of training activities and verification of personnel understanding shall be maintained. (ANSI/ANS-8.19, Section 5.3)

Lines of Inquiry:

- At a minimum, operators receive criticality safety training in accordance with ANSI/ANS-8.20, “Nuclear Criticality Safety Training.”
- Supervisors provide job specific training on procedures.
- Pre-job briefs cover criticality controls specific to the operations at hand.
- 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.
- Supervisors maintain training records for their personnel.
- Supervisors and operators can answer questions about the basic criticality controls for their operations.
- Supervisors can generally describe the contingencies and controls for the contingencies for their operations, including credited engineered features and key facility assumptions, if any.

3.2 Criterion: Supervisors shall develop or participate in the development of written procedures applicable to the operations under their control. Maintenance of these procedures to reflect changes in operation shall be a continuing supervisory responsibility. (ANSI/ANS-8.19, Section 5.4)

Lines of Inquiry:

- All fissile material handling operations are performed according to approved procedures.
- Operations personnel or supervision are involved in developing procedures.
- There is a mechanism to assure that only current, approved procedures, CSEs, and postings are used for operations.
- The line program supervisor has a formalized process that authorizes work only after all NCS requirements have been met subsequent to modifications of the existing set of controls/procedures.
- There is a mechanism to ensure that OSR related controls and requirements in procedures or postings are not changed without proper analysis by the NCS Staff and approval by management.
- Unreviewed Safety Question Determinations (USQDs) are performed for all procedure modifications.

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

Lines of Inquiry:

- The NCS Staff provides design input for all new or modified equipment.
- The NCS Staff reviews all operating procedures involving fissile materials.

- The NCS Staff reviews and concurs on final equipment and process designs.
- The NCS Staff reviews maintenance work orders that potentially affect criticality safety.

3.4 Criterion: The NCS staff shall maintain familiarity with all operations within the organization requiring nuclear criticality safety controls. (ANSI/ANS-8.19, Section 6.4)

Lines of Inquiry:

- The NCS staff observes fissile material handling and processing operations regularly.
- The NCS Staff attends operations planning meetings for new or restarted processes.
- The NCS Staff has access to, and familiarity with, fissile material operating procedures.
- The NCS Staff attends pre-job briefs and plan-of-the-day meetings when it is appropriate.
- The NCS Staff maintains familiarity with reports of deviations from expected process conditions even if these deviations do not result in a criticality infraction.

OVERSIGHT, AUDIT AND SELF-ASSESSMENT PRACTICES

4.1 Criterion: Management shall periodically participate in auditing the overall effectiveness of the nuclear criticality safety program. (ANSI/ANS-8.19, Section 4.6)

Lines of Inquiry:

- Contractor management participates in review teams or committees that assess facility criticality safety programs.
- Contractor program/facility management routinely audits operations for compliance with criticality safety requirements. Contractor performs NCS management self-assessments of their criticality safety staff and program.

4.2 Criterion: Management may use consultants and nuclear criticality safety committees in achieving the objectives of the nuclear criticality safety program. (ANSI/ANS-8.19, Section 4.7)

Lines of Inquiry:

- Management utilizes a nuclear criticality safety committee to assist in monitoring and improving the criticality safety program.
- Nuclear criticality safety committees report directly to the Senior Management.
- Personnel interviews indicate that findings from the nuclear criticality safety committee, or equivalent, are entered into a tracking database and corrective actions are tracked through implementation.
- Outside consultants are utilized to provide an independent viewpoint on the overall criticality safety program.

4.3 Criterion: The [NCS] staff shall conduct or participate in audits of criticality safety practices and compliance with procedures as directed by management. (ANSI/ANS-8.19, Section 6.6)

Lines of Inquiry:

- The NCS Staff participates in periodic audits of operations and procedures.
- The results of audits are shared among the NCS Staff.
- The results of audits are reported to appropriate Facility Management.
- Corrective actions are developed for Opportunities for Improvement.

4.4 Criterion: Operations shall be reviewed frequently (at least annually) to ascertain that procedures are being followed and that process conditions have not been altered so as to affect the nuclear criticality safety evaluation. (ANSI/ANS-8.19, Section 7.8)

Lines of Inquiry:

- All operations are reviewed at least annually.

- Annual reviews determine that procedures are being followed.
- Audits and reviews monitor the configuration of the facility and processes which could adversely affect criticality safety, such as movements of criticality detectors, installation of new equipment, inoperable emergency enunciators, etc.
- Personnel with NCS experience and knowledge of the operations perform the reviews.
- The reviews examine CSEs to verify that changes to the process have not compromised criticality safety.
- The results of the review are reported to senior management as well as Facility and Program Management.
- Opportunities for Improvement and proposed corrective actions are documented and tracked to closure.
- Procedures are in place to ensure that changes to process equipment over time do not degrade compliance with criticality safety controls.
- Annual reviews are conducted of facilities and operations where it has been determined that criticality is not credible but that contain more than a minimum critical mass of fissile material and/or that still require criticality safety controls.

4.5 Criterion: DOE must acquire and maintain sufficient knowledge of program activities in order to make informed decisions on criticality safety resources for these activities. (DOE P 450.5, Policy section)

Lines of Inquiry:

- Routine meetings are held with contractor NCS management.
- Periodic meetings are held with DOE contractor operations management?
- The DOE NCS Program Manager reviews budget requests made by contractor NCS management.
- The DOE NCS Program Manager reviews budget requests made by contractor operations management.
- The DOE NCS Program Manager has input to the DOE site budget process.

4.6 Criterion: DOE maintains operational awareness of contractor work activities, typically through DOE line managers and staff such as Facility Representatives and criticality safety subject matter experts. (DOE P 450.5, paragraph 2a)

Lines of Inquiry:

- The DOE NCS Program Manager and Facility Representatives work closely on NCS-related issues in the field.
- The DOE NCS Program Manager routinely spends time in the field performing walkdowns and interacting with Operations.
- The DOE NCS Program Manager reviews contractor occurrence reports related to criticality safety programs.

4.7 Criterion: DOE reviews performance against formally established criticality safety performance measures, performance indicators, and contractor self-assessments. (DOE P 450.5, paragraph 2b)

Lines of Inquiry:

- Performance measures are established for the contractor NCS program.
- Progress on the performance measures is routinely reported to DOE.
- Contractor NCS self-assessments are reviewed by the DOE NCS Program Manager.
- The NCS Program Manager provides reports and feedback on contractor self-assessments to senior DOE site management.

4.8 Criterion: DOE performs criticality safety reviews and assessments in support of required readiness assessments, Operational Readiness Reviews, Safety Management System documentation and onsite verification reviews, and authorization basis documents including Criticality Safety Evaluations (CSEs). (DOE P 450.5, paragraph 2c)

Lines of Inquiry:

- The DOE NCS Program Manager participates in readiness assessments, Operational Readiness Reviews, and Integrated Safety Management reviews when necessary.

- The DOE NCS Program Manager participates in the review and approval of facility NCS-related authorization basis documents (e.g., Safety Analysis Reports, Bases for Interim Operations, Unresolved Safety Questions, and Technical Safety Requirements).
- The DOE NCS Program Manager reviews a sample of contractor CSEs on a routine basis.

4.9 Criterion: DOE performs periodic appraisals of the contractor criticality safety program, including for-cause criticality safety reviews, as necessary. (DOE P 450.5, paragraph 2d)

Lines of Inquiry:

- Surveillances of facility criticality safety programs and controls are incorporated into the Field Office assessment plan.
- Appraisals and reviews are documented.
- Corrective actions are tracked to closure.
- The DOE NCS Program Manager performs assessments of the contractor criticality safety program in accordance with a documented plan.
- Outside DOE NCS subject matter experts are occasionally utilized to assist with reviews to provide independent feedback.

4.10 Criterion: DOE has a designated focal point for coordinating criticality safety oversight activities. (DOE P 450.5, paragraph 2)

Lines of Inquiry:

- The DOE Field Office has designated a single NCS focal point (i.e., NCS Program Manager).
- The DOE NCS Program Manager has been qualified by completing the requirements in the Federal NCS Qualification Standard.
- The DOE NCS Program Manager routinely meets with an Assistant Field Office Manager responsible for NCS.
- The DOE NCS Program Manager represents the single point of contact on NCS issues for the contractor.
- The DOE NCS Program Manager represents the Field Office on the Criticality Safety Coordinating Team (CSCT).