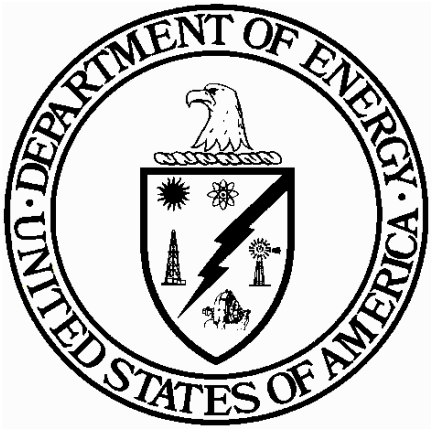
NOT MEASUREMENT SENSITIVE

DOE-STD-1158-2010
March 2010

# DOE STANDARD

## SELF-ASSESSMENT STANDARD FOR DOE CONTRACTOR CRITICALITY SAFETY PROGRAMS

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# FOREWORD

1 This Department of Energy standard is approved for use by all DOE Components and their contractors.

2 Beneficial comments (recommendations, additions, deletions) and any pertinent data that may improve this document should be sent to the Office of Technical Services, U.S. DOE/NNSA, Albuquerque Service Center, P.O. Box 5400, Albuquerque, NM, 87185-5400, by letter, or by using the self-addressed Document Improvement Proposal (DOE F 1300.3) appearing at the end of this document.

3 DOE Technical Standards, such as this standard, do not establish requirements. However, all or part of the provisions in a DOE standard can become requirements under the following circumstances:

(a) they are explicitly stated to be requirements in a DOE requirements document; or
(b) the organization makes a commitment to meet a standard in a contract or in an implementation plan or program plan required by a DOE requirements document.

Throughout this standard, the word "shall" is used to denote actions which must be performed if the objectives of this standard are to be met. If the provisions in this standard are made requirements through one of the two ways discussed above, then the "shall" statements would become requirements. It is not appropriate to consider that "should" statements would automatically be converted to "shall" statements, as this action would violate the consensus process used to approve this standard.

# ACKNOWLEDGEMENT

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# DEFINITIONS

Fissile Nuclide: A nuclide capable of undergoing fission by thermal neutrons.

Fissile material: A mixture of materials capable of some level of neutron multiplication from neutrons of any energy, and capable of self-sustained criticality in sufficient quantity or in certain conditions.

Fissionable Nuclide: A nuclide capable of undergoing fission by neutrons of some energy. Includes all fissile nuclides.

Fissionable Material: A mixture of materials capable of some level of neutron multiplication from neutrons of some energy, and capable of contributing significant addition to the neutron multiplication of a system or assembly.

- (For the purposes of this standard, *fissionable materials* are those that have a potential to cause a *criticality accident)*

# REFERENCES

10CFR830, *Nuclear Safety Management*
ANSI/ANS 8.1-1998, *Nuclear Criticality Safety in Operations with Fissionable Material Outside Reactors*
ANSI/ANS 8.3-1997, *Criticality Accident Alarm System*
ANSI/ANS-8.5-1996, *Use of Borosilcate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material*
ANSI/ANS 8.7-1998, *Nuclear Criticality Safety in the Storage of Fissile Materials*
ANSI/ANS 8.14-2004, *Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors*
ANSI/ANS 8.17-2004, *Criticality Safety Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors*
ANSI/ANS 8.19-2005, *Administrative Practices for Nuclear Criticality Safety*
ANSI/ANS 8.20-1991, *Nuclear Criticality Safety Training*
ANSI/ANS-8.21-1995, *Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors*

ANSI/ANS 8.23-2007, *Nuclear Criticality Accident Emergency Planning and Response*

ANSI/ANS 8.24-2007, *Validation of Neutron Transport Methods for Nuclear Criticality Safety Calculations*

ANSI/ANS 8.26-2007, *Criticality Safety Engineer Training and Qualification Program*

DOE O 420.1b, *Facility Safety*

DOE STD 3007-2007, *Guidelines for Preparing Criticality Safety Evaluations at Department Of Energy Nonreactor Nuclear Facilities*

DOE STD 1134-99 *Review Guide for Criticality Safety Evaluations*

# PURPOSE

The purpose of this document is to provide an assessment guide for review of DOE Contractor criticality safety programs. Assessment of elements as indicated in this Standard will evaluate whether the program meets the requirements of ANSI/ANS-8.19-2005, *Administrative Practices for Nuclear Criticality Safety*, as well as related ANSI/ANS-8 series standards and some requirements of DOE Order DOE O 420.1b. These standards represent the consensus practices for criticality safety programs. Although titled as a self-assessment standard, it is often used by DOE and external review teams. This standard may be used for evaluating nuclear criticality safety programs for facilities and activities that involve, or potentially involve, nuclides in quantities that are equal to or greater than the single parameter limits for fissionable materials listed in ANSI/ANS-8.1 and 8.15.

# SCOPE

This document encompasses all elements of the Contractor Criticality Safety Program at DOE facilities. The effectiveness of the criticality safety program is dependent upon management implementing its roles and responsibilities to integrate criticality safety into work practices as stated below:

An effective nuclear criticality safety program includes cooperation among management, supervision, and the criticality safety staff; for each employee, the program relies upon conformance with operating procedures. (Introduction to ANSI/ANS-8.19-2005)

The guidance was introduced and distributed at the Criticality Safety Self-Improvement Workshop, "Your Mission and Nuclear Criticality Safety," held in Las Vegas, Nevada in August 1999. The Department's Criticality Safety Support Group reviewed and endorsed this self-assessment guide prior to the August 1999 Workshop. The Deputy Secretary of Energy subsequently required all DOE sites to self-assess their criticality safety programs using the criteria reflected in the 2002 version of this guide in response to the Tokai-Mura criticality accident.

As stated in the foreword, this standard does not promulgate new requirements. Further, many of the lines of inquiry are open ended, which could be misapplied to create infinite requirements.

Some of the open-ended lines of inquiry are written in that fashion to force thought on the part of those doing the assessment; many are written in that fashion because the correct condition is not always the same. Of the lines of inquiry that are not open ended, the desired condition is not always in the affirmative, and in some cases the desired condition is not always the same.

The applicable DOE Order for criticality safety is DOE Order 420.1B, *Facility Safety*. It requires the development of a well-documented Criticality Safety Program, which incorporates compliance with ANSI/ANS Standards for criticality safety in effect as of the date of its issuance. The mandatory standard, ANSI/ANS-8.19-2005, *Administrative Practices for Nuclear Criticality Safety,* provides general and specific requirements and nuclear criticality safety program administrative criteria. Other ANSI/ANS-8 Standards provide additional requirements and criteria. Assessments of NCS programs assessments should capture the general and specific requirements from the order, the mandatory standards, and the administrative criteria provided in ANSI/ANS-8.19-2005. This assessment guide uses the seven primary elements of ANSI/ANS-8.19-2005. These are summarized in the specific lines of inquiry under the following broad categories:

- Management Responsibilities
- Supervisory Responsibilities
- Nuclear Criticality Safety Staff Responsibilities
- Operating Procedures
- Process Evaluation for Nuclear Criticality Safety
- Materials Control
- Planned Response to Nuclear Criticality Accidents

# ASSESSMENT REQUIREMENTS

Each of the following topics identifies criteria and associated lines of inquiry based on the major elements of ANSI/ANS8.19-2005 should be covered in a facility assessment activity at least once during a predetermined period. Experience has shown that an acceptable interval for self-assessing the criticality safety program, including all the material in this standard as it applies to a facility, is once every three years. This suggested interval may be adjusted to meet specific site or facility needs. The Assessor should establish appropriate lines of inquiry and may use

the ones suggested below or may generate their own for a given assessment activity. While these lines of inquiry may be used verbatim, tailoring them to site-specific applications and language is encouraged. These or other lines of inquiry are meant to stir discussion between assessors and facility staff and a positive or negative response to a question is not necessarily good or bad, but should be assessed in the context of the situation. Graded approach and cost/benefit considerations along with common sense must be associated with these discussions. Lines of inquiry that do not apply to a given facility should not be used. Finally, proper use of this self-assessment standard requires knowledgeable (i.e., in criticality safety and safety management) personnel performing extensive tours of facilities, interviews of personnel, reviews of documentation, and observations of work practices. Important safety issues may be missed entirely if assessments are limited to paperwork reviews only. Criticality safety related infractions and ORPS data, including conduct of operations occurrences potentially affecting criticality safety, are relevant to such reviews and should be utilized.

In addition to the Program assessment envisioned by these topic areas, an assessment application geared to a specific operation is recommended to glean how well the general program is working. This approach is often called a vertical slice.

In each of the topics and associated criteria that follow, specific lines of inquiry are presented that correspond to each of the major elements of ANSI/ANS-8.19-2005. These criteria are keyed to the ANSI/ANS 8.19-2005 Standard by the corresponding topic heading and subsection number within the Standard itself. Within this overall structure, additional guidance and requirements from DOE O 420.1B, 10CFR830, and other ANSI/ANS 8 Series criticality safety standards are included where appropriate. For example, see criterion 10.2.

Any items requiring correction (e.g., findings, deficiencies, or weaknesses) identified via the use of this standard shall be identified with the ANSI/ANS standard, DOE Directive, or local requirement (e.g., approved criticality program or site procedures) not met. The specific section not met should be identified. If a condition found violates multiple requirements, multiple sections and sources may be cited. Items which are not consonant with accepted, but not required, industry practice may only be discussed as opinion or non-required recommendation. These lines of inquiry shall not be used in lieu of requirements.

## 1.0 MANAGEMENT RESPONSIBILITIES

**Criteria: ANSI/ANS 8.19, Section 4.1, Responsibility for Safety, & DOE O 420.1b Specific Requirements.**

- Has management documented the Criticality Safety Program?
- Has DOE approved the Criticality Safety Program Description Document?
    - (a) Does the NCS program clearly delineate what is considered within the purview of the NCS program and what is not? (e.g., ANS-8 activities, ANS-1 activities, Less than significant quantity activities)
    - (b) Is it clear what NCS documents (e.g., process evaluation for criticality safety, nature of process determinations, incredibility arguments, non-fissile activity determinations) are to be used for analyzing various fissionable material operations?
- Does management demonstrate continuing commitment to criticality safety as evidenced by establishment of a formal approach to clearly identifying responsibility for nuclear criticality safety including training and periodic retraining of all operating and support personnel, conducting safety meetings, issuing safety bulletins, inspecting facilities on a regular basis, and ensuring a continuous commitment to improvement in safety?
- Does management demonstrate continuing commitment to criticality safety as evidenced by regularly scheduled meetings with the criticality safety engineers and the Nuclear Criticality Safety (NCS) manager?

**Criteria: ANSI/ANS 8.19, Section 4.2, Criticality Safety Policy**

- Does the Contractor have a written criticality safety policy?
- Are all fissionable 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?
- How is compliance to the criticality safety policy measured?
- Where is the criticality safety policy located?
- How is the criticality safety policy promulgated to employees?

**Criteria: ANSI/ANS 8.19, Section** 4.3, Responsibility for Implementing Policy

- Are the roles and responsibilities of the Criticality Safety Engineers (CSEs) documented?
- Are the roles and responsibilities of the NCS Manager and Organization documented?
- Are the roles and responsibilities of the Criticality Safety Officers (CSOs) 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: ANSI/ANS 8.19, Section 4.4, Criticality Safety Staff Independent of Operations**

- Does the Contractor provide sufficient funding to assure continuous support by NCS Staff?
- Does management provide discretionary funding to the NCS manager to provide training and professional development for the NCS staff, to address site or facility wide issues, to maintain and improve the NCS program documentation, and to ensure that criticality safety codes and platforms are verified and validated?
- Does the NCS Staff have unilateral, unscheduled access to the facility and operations personnel?
- Does the Contractor have a plan or policy to assure the NCS Staff is familiar with fissionable operations? Does the Contractor issue requirements for the qualification and training of NCS Staff, including subcontractors?
- Is the Contractor NCS Staff administratively independent of operations?

**Criteria: ANSI/ANS 8.19, Section 4.5 Training and Qualification of NCS staff**

- Has management established a qualification program for the criticality safety staff?
- Does the training and qualification program meet the requirements of DOE-STD-1135-99 or other program approved in accordance with DOE O 420.1B? (ANSI/ANS 8.26, *Criticality Safety Engineer Training and Qualification Program,* has been accepted at several sites.)
- Do all members of the NCS Staff have technical degrees in physics or nuclear engineering or another technical degree, or other training and experience judged appropriate by NCS management?
- How are the requirements and recommendations of DOE O 5480.20A and ANSI/ANS 8.26 implemented?

- Is the contractor's schedule and budget for the training and qualification adequate to assure qualified staff provides the necessary operational support?
- Is the contractor's record of qualifying staff to the standard satisfactory?
    (a) Can the initial and ongoing qualification of staff members be quickly observed from the training records?
    (b) Are the records consonant with the training requirements in the site criticality safety program?
    (c) See lines of inquiry for development of staff in section 4.6
- Has management provided sufficient numbers of qualified NCS staff members? The following can be indicators regarding sufficient numbers of staff.
    (a) Is the backlog of evaluations excessive?
    (b) Is Operations complimentary, dissatisfied, or non-committal with regard to field response for questions and issues?
    (c) How much overtime is used?
    (d) Are infractions unresolved for more than a few days?

**Criteria: ANSI/ANS 8.19, Section 4.6, Monitoring the Criticality Safety Program**

- Has management defined audit requirements and criteria for the NCS 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 metrics provide clear indication of whether the program is improving?
    - Do the metrics encourage continuous improvement?
    - Do the criticality safety performance metrics encourage self-reporting of deficiencies?
    - Do the criticality safety performance metrics promote practices that prevent repeat criticality safety infractions of the same type or for the same operation or process?
    - 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? Areas to be monitored may include:
        (a) the training and qualification program of nuclear criticality safety staff;
        (b) professional development;
        (c) participation in the American Nuclear Society Nuclear Criticality Safety Division;
        (d) preparation of technical papers;

(e) attendance of criticality safety courses.

(f) teaching of criticality safety courses.

This list is not exhaustive.

- Are assessment applications geared to a specific operation (i.e. vertical slice assessments) used to indicate how well the general program is working?
- 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 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?
- Does the Contractor perform assessments of compliance to operating procedures?
- Does the Contractor assess implementation of conduct of operations?
- How are NCS funding levels proposed and approved?
- How does management determine that funding for NCS is sufficient? Is there a mechanism for adjusting the funding during the fiscal year?

**Criteria: ANSI/ANS 8.19, Section 4.7, Participation in Audits**

- Does management participate in review teams or committees to assess facility criticality safety?
  - (a) Is the participation frequent enough to be considered reasonable and prudent?
  - (b) Is there a systematic schedule of audits or assessments that will assure all areas of the program are assessed periodically, e.g., every three years?
  - (c) Are biennial or triennial reviews by management and offsite consultants used?
- Does management routinely and adequately audit operations for compliance to criticality safety requirements?
- Does the Contractor perform NCS management self-assessments of their criticality safety staff and program?

**Criteria: ANSI/ANS 8.19, Section 4.8, Nuclear Criticality Safety Committees**

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

- If a nuclear criticality safety committee is used, how are the responsibilities and authority of the committee established and documented?
- If nuclear criticality safety committees are used, do they report directly to the Senior Management?
    (a) Are the findings from the nuclear criticality safety committee, or equivalent, entered into a tracking database,
    (b) Are corrective actions implemented?
- Are outside consultants utilized to provide an independent viewpoint on the overall criticality safety program?

**Criteria: ANSI/ANS 8.19, Section 4.9, Configuration Management**

- Are facility and process conditions important to criticality safety clearly identified in safety documents? (e.g. process evaluations for criticality safety, facility design documents, authorization basis documents as needed)
- Are these conditions communicated to operational and maintenance staff?
- Is there a reliable process documented to control changes to these conditions to assure proper consideration to criticality safety is provided?
- Are facility and process conditions important to criticality safety being managed in accordance with the defined configuration management program?

## 2.0 SUPERVISORY RESPONSIBILITIES

**Criteria: ANSI/ANS 8.19, Section 5.1, Responsibility for Safe Operations**

- Do 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 process evaluations for criticality safety;
    (4) participating in the development of credible process upsets for the NCS staff to consider; and
    (5) approving process evaluations for criticality safety for operations?
- Do supervisors ensure that operators participate in the development of process evaluations for criticality safety, identification of credible process upsets, limits, and controls including identification of engineered controls?

**Criteria: ANSI/ANS 8.19, Section 5.2, Knowledge of Criticality Safety**

- How do supervisors review credible process upsets and criticality accident scenarios analyzed by the NCS staff during development of the process evaluation for criticality safety?
    - (a) How are the results of this review documented and incorporated into the evaluation?
- Do supervisors and operators under their supervision identify practical engineered controls that can be implemented in lieu of administrative controls during the preparation and review of process evaluations for criticality safety and limits?
- Do supervisors understand the underlying assumptions in process evaluations for criticality safety such as configuration of equipment, facility modifications, isotopic composition?
- Is the Nuclear Criticality Safety Staff requested to provide NCS training to 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 management and supervision regarding implementation of NCS controls?

**Criteria: ANSI/ANS 8.19, Section 5.3, Personnel Training**

- Do personnel who manage, work in, or work near facilities where the potential exists for a criticality accident receive criticality safety training in accordance with ANSI/ANS-8.20, “Nuclear Criticality Safety Training?”
- Has the contractor implemented DOE O 5480.20a, and done self-assessments to verify implementation?
- Is training appropriately tailored for the personnel’s responsibilities?
- Do supervisors provide job specific training on procedures?
- Are walkthroughs and dry runs on operational 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 such as work restrictions due to criticality safety infractions, availability of new procedures and postings, need for NCS Staff participation, results of recent criticality safety assessments or surveillances?
- 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 to criticality safety postings?
- Can supervisors and operators answer questions about the basic criticality controls for their operations?
- Can supervisors generally describe the normal conditions, key assumptions, credible abnormal conditions, and controls for their operations?
    (a) If applicable, can supervisors also describe the necessary engineered features and key facility assumptions?
- Do supervisors ensure that personnel have demonstrated an understanding of procedures and criticality safety postings prior to authorizing work?
- Are there records of job specific training on operational procedures and criticality safety postings?
- Do supervisors request assistance from the Nuclear Criticality Safety Staff to provide training for operations personnel?
- Do firefighters receive criticality safety training?
- Are firefighters aware of any moderator-controlled areas or processes?
- Are firefighters made aware of locations where a mist condition could credibly affect criticality safety?
- Do operations support, engineering & design, and maintenance personnel receive criticality safety training which is commensurate with their assigned responsibilities?

**Criteria: ANSI/ANS 8.19, Section 5.4, Operating Procedures**

- Are all fissionable material handling operations performed according to approved procedures?
- Are operations personnel or supervision involved in developing procedures?
- Is there a mechanism to assure that only current approved procedures, process evaluations for criticality safety, and postings are used for operations?
- How are changes such as changes in safety documentation communicated to operators?
- How timely is this communication?
- How does the supervisor know when to authorize work?
- How does supervision verify that NCS requirements have been met?

- How does the supervisor know that modifications to the controls and procedures have been implemented?
- Does a clear, unambiguous link between the process evaluation for criticality safety, procedure, and posting exist such that it is traceable from floor level documentation?
- Is there a mechanism to ensure that TSR related controls and requirements in procedures or postings are not changed without proper analysis and approval?
- Are Unreviewed Safety Question Determinations (USQD) performed for relevant procedure modifications impacting nuclear criticality safety?

**Criteria: ANSI/ANS 8.19, Section 5.5, Maintaining Compliance with Requirements**

- What is the process for ensuring that no new or modified operation is started until all applicable verification steps have been performed, including presence of approved process evaluations for criticality safety, postings, and procedures?
- Are appropriate surveillance frequencies established for engineered controls relied upon for criticality safety to ensure that the controls are performing their intended function?
- Are transfers from favorable to unfavorable geometry appropriately analyzed and adverse effects prevented or mitigated?"

**Criteria: ANSI/ANS 8.19, Section 5.6, Inspection, Testing and Maintenance of Engineered Controls**

- Are there procedures or mechanisms in place and implemented to ensure that modifications to equipment, particularly engineered controls, and changes to processes result in a review of the applicable process evaluations for criticality safety, procedures, and posting sets prior to implementing the modification?
- Are there documented surveillances or methods that ensure that new or modified operations conform to applicable CSEs, procedures, and postings?
- Are periodic inspection, testing, and maintenance requirements being effectively implemented?
- What is the role of supervision in these processes?

**Criteria: ANSI/ANS 8.19, Section 5.7, Labeling and Good Housekeeping Practices**

- Are stored, empty containers labeled as such where there could be uncertainty as to whether or not containers are empty?
- Are gloveboxes with criticality drains free of loose debris, which could potentially clog the drain?
- Is fissionable material stored in approved containers?
- Is there a procedure to verify compliance with criticality safety requirements prior to beginning work?
- Is there evidence of fissionable material holdup or filings in gloveboxes?
- Are criticality drain liquid traps monitored for adequate liquid levels periodically?

## 3.0 NUCLEAR CRITICALITY SAFETY STAFF RESPONSIBILITIES

**Criteria: ANSI/ANS 8.19, Section 6.1, Technical Guidance for Design of Equipment and Processes**

- Does the NCS Staff provide design input for all new or modified equipment?
- Is the design input provided early enough to be incorporated without rework?
- Does the NCS Staff review all operating procedures involving fissionable materials?
- Does the NCS Staff review and concur on final equipment and process designs?

**Criteria: ANSI/ANS 8.19, Section 6.2, Required Knowledge and Capability**

- How many members of the Nuclear Criticality Safety Staff understand and know how to properly utilize Monte Carlo codes (e.g., KENO and MCNP), criticality safety handbooks, critical experiment data, hand-calculations, etc.?
    - (a) Are there any other evaluation methods used?
    - (b) How many of the staff are skilled with all the methods mentioned and any other methods used at the site?
- Does the NCS staff demonstrate appropriate use of ANSI/ANS standards and DOE Orders in performing criticality analyses?
- Does the Nuclear Criticality Safety Organization maintain verified and validated computational techniques for performing process evaluations for criticality safety for the site?
    - (a) Are the DOE Software Quality Assurance requirements met?

(b) Are the software licensing requirements met?

(c) How is code verification and validation conformance with ANSI/ANS 8.1, 8.24, and 8.17 (as applicable) documented?

- Does the Contractor NCS Staff participate in professional development activities such as ANS Standards Committees, ANS Meetings, workshops and training courses sponsored by the Nuclear Criticality Safety Program, or university courses, consistent with the contractors training and qualification program requirements?
- Is the training and qualification program consistent with DOE STD 1135 or included in the approved NCS Program Description Document?
- Does the NCS Staff have working knowledge of criticality safety related standards, guides, and codes?

**Criteria: ANSI/ANS 8.19, Section 6.3, Consulting with Knowledgeable Individuals**

- Does a synergistic interaction exist among NCS Staff assigned to specific facilities and the remainder of the Contractor NCS staff?
- Does the NCS Staff consult with offsite criticality safety experts as needed, particularly retirees from the facility?
- How often does NCS Staff find it useful to consult with offsite criticality safety experts?
- Do external experts periodically review contractor NCS documents and provide feedback and suggestions for improvement?

**Criteria: ANSI/ANS 8.19, Section 6.4, Familiarity with Operations**

- Does the NCS staff observe fissionable material handling and processing operations for which they provide guidance?
- Are members of the NCS Staff knowledgeable and conversant with facility operators about 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 fissionable material operating procedures?
- Does the NCS Staff attend pre-job briefs and plan-of-the-day meetings?
- Does the NCS Staff work with cognizant systems and process engineers to understand process operations and impacts of process changes and upsets?

- Does the NCS Staff maintain familiarity with reports of deviations from expected process conditions (e.g., procedural errors, equipment failures, spills, leaks) even if these deviations do not result in a criticality infraction?

**Criteria: ANSI/ANS 8.19, 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?
- Is the essential information to be conveyed clearly identified?

**Criteria: ANSI/ANS 8.19, Section 6.6, Audits**

- Has management defined audit expectations for the NCS Staff? (e.g., audits of operations, procedures, configuration control systems, and emergency response, number, frequency, and depth of audits and walkthroughs)
- 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 management?
- Are corrective actions developed for deficiencies?
- Are corrective actions taken in a expeditious manner?

**Criteria: ANSI/ANS 8.19, Section 6.7, Investigation of Criticality Safety Violations and Deficiencies**

- Are nonconformances with criticality safety requirements reported to and reviewed by the NCS Staff?
- Does the NCS Staff formally report findings and recommendations to management?
- Are lessons-learned developed and recommendations to prevent recurrence made to management?
- Are all criticality safety related deficiencies 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?

- How are lessons learned from criticality safety related deficiencies at either local or offsite facilities developed and applied by the NCS Staff?
- How does the NCS staff develop and apply lessons learned from accidents not apparently related to criticality safety? (e.g., Chernobyl, Bhopal, Columbia, Challenger

## 4.0 OPERATING PROCEDURES

**Criteria: ANSI/ANS 8.19, Section 7.1, User-Friendly Procedures**

- Are criticality controls in procedures clear, concise, free of criticality safety jargon, and easily identifiable?
- Is the criticality safety related information presented in procedures free of unnecessary detail and directly applicable to the job task being performed?
- Do the operators find the criticality safety related instructions easy to understand and follow?
- How are procedures used in the work area?
    (a) Does the contractor have a mechanism to determine how procedures are to be used during the operation (e.g., in-hand, readily available)?

**Criteria: ANSI/ANS 8.19, Section 7.2, Criticality Controls**

- Are criticality controls that the operator can influence included in operating procedures?
- Is there a clear, unambiguous, link between criticality controls in procedures and postings and their parent process evaluation for criticality safety?
- Does the Contractor have a formalized process for determining which controls are incorporated in procedures?
- Do pre-fire plans incorporate criticality safety controls?
- Are firefighters trained and familiar with applicable criticality safety controls and practices?
- Does the NCS staff review and provide specific input to safety assessments and evaluations of other hazards that may involve criticality safety concerns?
- Are criticality related instructions in pre-fire plans and firefighting procedures practical under actual conditions of responding to fires?

**Criteria: ANSI/ANS 8.19, Section 7.3, Maintaining Current Procedures**

- Are procedures revised based on lessons learned to reduce occurrence of deviations and infractions?

- Do operators have a feedback process whereby improvements to procedures can be implemented?
- Are adequate resources available to facilitate procedure improvements as they are identified?
- Are procedure revisions timely?
- What change control mechanism is in place that assures only the current, approved procedures are utilized?

**Criteria: ANSI/ANS 8.19, Section 7.4, Periodic Procedure Review**

- Has management defined periodic review critieria, including what is meant by "periodic," for the supervisory staff?
- Are procedures periodically reviewed?
- Does the NCS Staff periodically participate in reviews of active operating procedures?
- What mechanisms are in place to ensure that all procedures are reviewed as planned?

**Criteria: ANSI/ANS 8.19, Section 7.5, Nuclear Criticality Safety Staff Review**

- Do new or revised procedures that have a potential impact on criticality safety receive review by the NCS Staff? How is the determination of potential impact made?
- Does the NCS staff periodically review and/or observe operations in progress?
- Is there a mechanism for resolving conflicting comments from the NCS Staff and the other reviewers?

**Criteria: ANSI/ANS 8.19, Section 7.6, Criticality Safety Postings**

- Are methods other than postings (e.g., checklists, flow sheets, or automated systems) used to supplement procedures?
- How do methods other than postings provide aids to compliance with criticality safety limits and controls?
- If methods other than postings are used, how do they provide equivalent or better aid to compliance than would be provided by postings?
- Are criticality safety postings easy to understand by operators?
- Do the postings contain only information controlled by the operator performing the task?

- Do the postings require any analysis on the part of the operator such as decoding “IF-THEN”, “EITHER-OR” type options to select appropriate controls?
- What is the relationship between the controls in the posting and the controls in the procedures?
- Is there a formalized process for determining which controls appear on postings and which appear in procedures?
- What mechanism is in place to ensure that the controls in the posting are consistent with those intended by the parent process evaluation for criticality safety?
- Are postings easy to read from normal operator positions at the workstation?
- Do operators rely primarily on postings to obtain their criticality safety controls?
- Are nuclear criticality safety controls that are to implemented by operators included in postings? If not, are the operators trained on how to find all the controls applicable to the process?
- Is it possible to comply with the requirements of the posting and still incur a criticality safety infraction because additional controls are contained in the procedures? If so, is there a process for directing operators to the complete set of required controls?

**Criteria: ANSI/ANS 8.19, Section 7.7, Response to Criticality Safety Infractions, Violations, or Deficiencies**

- How are infractions graded?
- Does the nonconformance reporting system encourage discovery and reporting by operations staff rather than safety or oversight personnel?
- Are the contingencies and barriers for a given operation readily available to the NCS Staff investigating potential infractions?
- How does the NCS Staff determine the safety of immediate corrective actions for a violation condition?
- How does the NCS staff determine the remaining controls and controlled parameters when an infraction, violation, or deviation condition is discovered?
- Do procedures exist to upgrade and to properly characterize the assigned severity level of infractions due to adverse trends?
- Do procedures exist to upgrade and to properly characterize the assigned severity level of infractions due to the magnitude of the decrease in the margin of subcriticality?

- What is the required response when a potential infraction is identified? How is this communicated to operations and supervision?
- Does the NCS Staff respond to the scene of a potential infraction?
- Are the responsibilities defined for responding to a potential infraction?
- Does the NCS Staff participate in management critiques of infractions, assigning levels of infraction, and developing corrective actions?
- Are infractions resolved promptly and normal operations restarted?
- When the NCS Staff recommends immediate corrective actions to recover from an infraction, are these recommendations made in writing, peer reviewed, and approved by management?
- Are corrective actions stemming from criticality infractions entered into a tracking database and monitored until closure?
- Are minor criticality infractions tracked and trended?
- Are root causes determined where trends or patterns are identified?
- Are root causes of nonconformances determined and documented?
- When Formal Root Cause Determinations are not done how are recurrence prevention actions determined? Are approved methodologies (e.g., training, procedures, or skill-of-the-craft) used?
- Are all criticality infractions, regardless of severity, properly analyzed and dispositioned?

**Criteria: ANSI/ANS 8.19, Section 7.8, Annual Operations Reviews**

- Are all operations reviewed at least annually?
- How do annual reviews determine that procedures are being followed?
- Do 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.?
- Do personnel with NCS experience and knowledge of the operations participate in the reviews?
- Do the reviews examine process evaluations for criticality safety to verify that changes to the process have not compromised criticality safety?
- Are the results of the review reported to senior management as well as other appropriate 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 process evaluation for criticality safety 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?

**Criteria: ANSI/ANS 8.19, Section 7.9, Reviews for Operations in Extended Shutdown**

- Has the extent and frequency of needed reviews to ensure conditions have not changed been defined and documented?
- Are these reasonable for the post-shutdown process conditions?
- Are these reviews being conducted where required?

## 5.0 PROCESS EVALUATION FOR NUCLEAR CRITICALITY SAFETY

**Criteria: ANSI/ANS 8.19, Section 8.1, Analysis of New and Modified Operations**

*General Issues*

- How do the process evaluations for criticality safety demonstrate that operations will remain subcritical under normal and credible abnormal conditions?
- Is there evidence of applying the double contingency recommendation in lieu of the requirement to demonstrate that operations will remain subcritical under normal and credible abnormal conditions?
- Do procedures exist for generating process evaluations for criticality safety?
- Are the process evaluations for criticality safety performed in a timely fashion?
- Does staff familiar with the facility and operations under consideration perform the process evaluations for criticality safety?
- Does the NCS Staff have access to archived process evaluations for criticality safety as reference?
- Do criteria and procedures exist to determine the magnitude of process change, which can be implemented without revising the process evaluation for criticality safety?

*Hazard Evaluation*

- Is an appropriate systematic and comprehensive hazard evaluation process used to identify credible upset conditions that could lead to a criticality accident?
- Does the evaluation demonstrate that no single credible event or failure can result in a criticality accident?
- Are these hazard identification processes documented sufficiently so a qualified reviewer can confirm the conclusions?
- Does this process consider hazards from natural phenomena hazards, such as seismic and flooding?
- Are credible abnormal conditions identified in the safety basis documents (e.g., DSA, BIO, Transportation Safety Document) considered as appropriate in the process evaluations for criticality safety?
- Are firefighting scenarios considered (e.g., addition of moderator, displacement of fissionable material in water streams, etc.)?
- Does this process incorporate lessons learned from previous facility upset conditions and criticality control nonconformances?
- Are the contingencies to be evaluated jointly developed by the NCS staff and responsible operations personnel?
    (a) How do personnel from other organizations and disciplines (e.g., systems and process engineering, material control and accountability, safeguards and security, health physics ) aid in the development of contingencies to be evaluated?
- Does the NCS Staff work as a team with operations to develop credible accident scenarios and controls?
- Does application of the double contingency principle involve unlikely changes in parameters, not simply failures of a control or other failures?
- Does NCS Staff assist in developing overall Hazard Categorization of facilities as described in 10CFR830?

*Role of Calculations*

- Is comparison to experiment used in preference to calculations for determining subcritical limits?
- 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?

- Where hand calculations, handbook data, experiment data, etc., are used, are the limitations and proper use of each recognized?
- Are calculations validated by comparison to applicable experiment benchmark data?
- Is a sensitivity and uncertainty analysis technique (e.g., TSUNAMI) used to select and verify applicability of the selected benchmarks?
- If light water reactor fuel is handled, how are ANSI/ANS-8.17, "*Criticality Safety Criteria for Handling, Storage, and Transport of LWR Fuel Outside Reactors*" and ANSI/ANS-8.27, "*Burnup Credit for LWR Fuel?"* applied?
- How are calculational methods validated? If validation is being reviewed, consult ANSI/ANS-8.24, "*Validation of Neutron Transport Methods for Nuclear Criticality Safety Calculations?"* for more detailed guidance.
- Is the validation, including treatment of bias and bias uncertainty, documented?

**Criteria: ANSI/ANS 8.19, Section 8.2, Evaluation of Controlled Parameters**

- Do process evaluations for criticality safety and procedures for evaluations emphasize the preferred order of controls (i.e., passive engineered controls, active engineered controls, then 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, unlikely changes in process conditions, and credited controls explicitly documented?
- Are controls developed in the process evaluation for criticality safety for each contingency?

**Criteria: ANSI/ANS 8.19, Section 8.3, Documentation Requirements**

- How is DOE-STD-3007-2007, *Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Nuclear Facilities*, (or equivalent) applied in the preparation of the process evaluations for criticality safety?
- Do the process evaluations for criticality safety contain a system or process description with enough detail for an independent reviewer to understand the system or process sufficiently to judge the results of the criticality safety analysis?

- Is there a change control and document control system in place for process evaluations for criticality safety?
- 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?
- How are assumptions needed to assure subcriticality documented in the process evaluations for criticality safety?
- Can appropriate sections of the process evaluation for criticality safety (e.g., the process description, discussion of contingencies and credible abnormal events, criticality safety controls) be read and understood by the supervision?
- How are evaluations and material containing sensitive or classified data handled?

**Criteria: ANSI/ANS 8.19, Section 8.4, Independent Review**

- Do all process evaluations for criticality safety receive an independent technical peer review before approval for use?
- Does the peer review include a walk down or visit to the work location?
- 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?
- Is the review done in accordance with DOE STD 1134 (or other methodology as described in the local DOE approved nuclear criticality Safety program description document)?
    - (a) How does the review process incorporate the elements of DOE-STD-1134, augmented by site or complex lessons learned?
    - (b) Are review comments formally documented and dispositioned?
    - (c) If DOE STD 1134 is not the peer reviewer guidance, are the elements to be addressed by peer reviewer formally documented?

## 6.0 MATERIALS CONTROL

**Criteria: ANSI/ANS 8.19, Section 9.1, Fissionable Material Movement**

- Are procedures in place to control the movement of fissionable material between material balance areas?
- Are procedures in place to control movement of fissionable material within a single material balance area?
- Are procedures in place to control transfers of fissionable material into and out of the facility?
- Do the procedures have requirements to verify compliance with criticality safety limits at the shipping and receiving points of the transfer prior to performing the movement?
- Is there a formal process to maintain a running log of fissionable mass contained in gloveboxes, storage arrays, or other fissile material handling operations? Is this log readily available to the operators?

**Criteria: ANSI/ANS 8.19, Section 9.2, Labeling and Posting Requirements**

- Do fissionable material labels contain all the information necessary to determine compliance to applicable NCS controls such as fissionable mass, cladding, moderators, chemical form, shape, isotopic composition,?
- Are all fissionable material storage areas posted as such with criticality controls clearly identified?
- Can the mass and location of all fissionable materials in a glovebox be determined by operator or supervisor inspection of logs (or equivalent) posted on the glovebox? Are these logs (or equivalent) readily available to contractor and DOE oversight personnel?
- Can the operator readily determine compliance with applicable limits from the information available at the workstation?

**Criteria: ANSI/ANS 8.19, Section 9.3, Use of Neutron Absorbers**

- Are any processes dependent upon the presence of fixed neutron absorbers?
- Are controls in place to monitor the continued effectiveness of credited neutron absorbers?
- Are any soluble neutron absorbers credited?
- If soluble neutron absorbers are credited, are procedures in place to ensure they remain in their intended distribution and concentration as required by ANSI/ANS 8.14-2004, *Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors*?

- Are practices dealing with borosilicate Raschig rings consistent with ANSI/ANS-8.5, "*Use of Borosilcate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material*"?
- Are practices dealing with soluble neutron absorbers consistent with ANSI/ANS-8.14, *Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors?"*
- Are practices dealing with fixed neutron absorbers consistent with ANSI/ANS-8.21, *Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors?"*

**Criteria: ANSI/ANS 8.19, Section 9.4, Control of Fissionable Material Areas**

- Is access to fissionable material handling areas controlled such that only trained, qualified, and authorized personnel can handle fissionable material?
- Does management or supervision verify the qualification of fissionable material handlers prior to authorizing work?

**Criteria: ANSI/ANS 8.19, Section 9.5, Control of Physical Parameters**

- How is interaction between containers of residue and product fissionable material in storage controlled? (e.g., fixed arrays, attached engineered spacers, type B containers)
- When administrative spacing controls are used, has the process evaluation for criticality safety demonstrated that the system will remain subcritical in a seismic event?
- How are potential violations of administrative spacing controls addressed in process evaluations for criticality safety?
- Where engineered features are credited for criticality control, are initial and periodic inspections conducted to verify they are capable of performing the intended function?
- When periodic determination of the effectiveness of engineered features is required, how is the periodicity determined?
- For solution storage areas, is solution stability understood? For example:
    (a) are procedures in place to detect concentration and stratification changes in the solution?
    (b) Are unsafe liquid levels or unsafe solution concentrations prevented by engineered controls where practical?
    (c) Are fissile solutions periodically monitored for changes in pH?
    (d) Do double-block-and-bleed valve arrangements, or equivalent, where the addition of fissile material is prohibited, protect isolated, inactive fissile solution storage tanks?
    (e) Are temperature dependent effects and reactions considered

- Has the process evaluation for criticality safety determined that all storage vaults, gloveboxes, and solution storage arrays will remain subcritical under the same design conditions that the building or structure is designed to withstand (e.g., seismic events, flooding, high winds)?
- Does the process evaluation for criticality safety evaluate the effects of credible, natural phenomena events that are within the design basis, and show that no single credible abnormal event can cause a criticality accident?
- Does fissionable material holdup in process vessels, gloveboxes, the HVAC, and other accumulation points present a credible criticality accident scenario?
- Are programs and procedures in place for detecting and characterizing accumulations as required by DOE O 420.1B for facilities and equipment that could inadvertently accumulate significant quantities of fissionable materials?
- Is holdup of fissionable material being effectively monitored and controlled as required?
- Will fissionable material remain subcritical under credible firefighting scenarios, including within or adjacent to moderator controlled areas?
- Are fissionable material storage areas consistent with ANSI/ANS-8.7, “Guide for Nuclear Criticality Safety in the Storage of Fissile Materials?”
- Are practices dealing with control of moderators consistent with ANSI/ANS-8.22, “*Nuclear Criticality Safety Based on Limiting and Controlling Moderators?”*

**Criteria: ANSI/ANS 8.19, Section 9.6, Consideration of Extended Shutdown**

- Is there a process to assure criticality safety review of equipment that is in a state of extended shutdown where fissionable material characteristics can change?

## 7.0 PLANNED RESPONSE TO NUCLEAR CRITICALITY ACCIDENTS

**Criteria: ANSI/ANS 8.19, Section 10.1, Criticality Accident Alarm Systems**

For further guidance, see ANSI/ANS 8.3, *Criticality Accident Alarm System*

- How are criticality accident alarm systems are evaluated and approved?
- Does documentation exist to demonstrate that the installed criticality detectors can detect the minimum accident of concern?
- Does documentation exist to show that existing criticality detector coverage provides the necessary redundancy at the required detection thresholds?

- Is there one group responsible for analyzing criticality detector locations?
- Is there a procedure that governs the evaluation of criticality detector locations?
- Is there documentation that the audible alarm signal requirements of ANSI/ANS-8.3 are satisfied?
- Where audible alarms do not satisfy ANSI/ANS-8.3 signal requirements, are alternate means of notification for personnel implemented and functioning (e.g., beacons present and visible?)
- Is the criticality accident alarm system designed to minimize false alarms?
- Is there an organization responsible for the design, maintenance and testing of criticality accident alarm system hardware?
- Is testing and maintenance of criticality accident alarm systems performed to approved procedures?
- Are testing and maintenance records being maintained?
- When portable, temporary alarms are used, do they meet the requirements of ANSI/ANS-8.3?
- Before portable, temporary alarms are used, is there an analysis to demonstrate that the detectors will alarm if the minimum accident of concern occurs?

**Criteria: ANSI/ANS 8.19, Section 10.2, Emergency Procedures**

For further guidance, see ANSI/ANS 8.23, *Nuclear Criticality Accident Emergency Planning and Response.*

Criteria: ANSI/ANS 8.23, Section 4, Management and Staff Responsibilities

- Does the NCS Staff have a role in responding to criticality accidents?
- Are potential criticality accident locations identified?
- How are potential accidents characterized?
- How is the immediate evacuation zone determined?
- What capability to perform radiological dose assessments for response to criticality accidents is in place?
- Is a nuclear accident dosimetry system in place?

Criteria: ANSI/ANS 8.23, Section 5, Emergency Response Planning

- Are emergency procedures available and approved?

- Has the emergency response planning, (e.g. response, rescue, re-entry, and recovery procedures) considered the possibility of an extended, sustained power criticality event?
    (a) How were the planning decisions made?
    (b) How was the sustained accident type selected?
    (c) How were the credible, bounding accident scenarios for emergency planning determined?
- Do offsite organizations participate in emergency exercises for criticality scenarios?
- Do offsite organizations required to respond in the event of a criticality accident have emergency response procedures?
    - Offsite refers to non-contractor, non-DOE organizations such as hospitals, law enforcement, fire departments, and paramedics.
- Are procedures in place to provide estimates of source terms and fission estimates in the event of a criticality accident?
- Are offsite responders aware of the plant conditions that might be encountered in the event of a criticality accident?
- Are personnel assembly stations clearly identified?
- Have the designated assembly areas been analyzed in advance to minimize radiation exposures from a criticality accident?
- Do procedures exist to account for all facility personnel, including visitors, in the event of an evacuation?
- Will more than one facility go into alarm if a criticality accident occurs?
- Is an emergency command center established for criticality accident drills?
- Are procedures in place to care for injured and exposed personnel?
- Are area hospitals equipped and trained to handle personnel with extreme radiation exposures?
- Are procedures in place to deal with contaminated personnel?

Criteria: ANSI/ANS 8.23, Section 6, Evacuation

- Do emergency procedures designate evacuation routes?
- Are evacuation routes identified and avoid areas of higher risk?
- Are facility visitors indoctrinated in proper evacuation procedures?
- Do radiation monitoring personnel respond to the assembly areas to monitor for radioactive contamination?
- Are procedures in place to monitor radiation levels at the assembly areas?

- Are procedures in place to move personnel from designated assembly areas in the event an unacceptably high radiation field is encountered?

Criteria: ANSI/ANS 8.23, Section 7, Reentry, Rescue, and Stabilization

- Does the NCS Staff have a role in responding to criticality accidents?
- How does the technical staff determine if an accident system is subcritical?
- How does the technical staff develop advice to management for methods to ensure stabilization of equipment and safe conditions for personnel?
- If intervention may be required (e.g., poisons, breaching) to drive the system subcritical, are the equipment and materials readily available?
- Do emergency response procedures address re-entry and clearly identify the incident commander responsible for approving re-entry?
- Can the criticality alarm system be reset remotely prior to re-entry?
- What is the membership of re-entry teams?
- Are members trained in the use of proper equipment such as portable radiation monitoring equipment, portable communications equipment and supplied breathing air?
- Are members trained in emergency response and re-entry?
- Does the incident commander have pre-determined criteria for authorizing re-entry?
- How will the possibility of continuing or recurring criticality be addressed in re-entry planning?
- Are appropriate radiation detectors available to ascertain the state of a criticality accident that has occurred?
- Are radiation monitoring personnel trained in the interpretation of radiation data as it pertains to an ongoing criticality accident?
- Are radiation readings reported to the emergency command center?

Criteria: ANSI/ANS 8.23, Section 8, Training, Exercises and Drills

- Are personnel trained to evacuate by the safest route?
- Do personnel know where they are to assemble?
- Are criticality drills performed at least annually?
- Does the alarm tone for a drill mimic the alarm that will be heard in a real accident?
- Are personnel pre-staged for criticality alarm drills or are they at their normal work locations?
- Do multiple buildings participate in criticality alarm drills?

- Is an emergency command center established for criticality accident drills?
- Do radiation monitoring personnel participate in criticality drills?
- Does the incident commander have pre-determined criteria for authorizing re-entry?

# Appendix A: Summary Statements of the Criteria

These summary statements should not be substituted for the lines of inquiry given above. However, they may be useful for text in Criteria Review and Approach Documents (CRADS and review plans. When used, a statement should be included saying that the lines of inquiry from this standard will be used. Revision of the long statements to bullet form when copied may be useful.

- **Management Responsibilities:** Management demonstrates owns and participates 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 fissionable 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:** Supervision accepts responsibility for the criticality safety of their operations; supervisors understand the controls, contingencies, and criticality safety bases 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 fissionable 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 fissionable material; the staff maintains familiarity with criticality codes, guides, standards, and best practices; the staff interacts, 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 fissionable material are reviewed by the nuclear criticality safety staff; procedures contain appropriate criticality controls implemented by the operators; are supplemented by postings; postings are easily visible under all anticipated lighting conditions, and understood by operators; deviations from procedures and processes and criticality infractions are investigated promptly, documented, reported to management, and 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 that affects the applicable nuclear process evaluation for criticality safety. 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, and participating in regular assessments.

- **Process Evaluation for Nuclear Criticality Safety:** All fissionable material operations are analyzed to show that the processes will remain subcritical under all normal and credible abnormal conditions; the process evaluation for criticality safety (commonly called the criticality safety evaluation) is documented in a clear unambiguous manner; contingencies and controls are explicitly identified; calculational methods are properly verified and 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 process evaluations for criticality safety, limits, and postings are used; and process evaluations for criticality safety are independently peer reviewed before operations are authorized.

- **Materials Control**: Movement of fissionable materials is controlled; fissionable material is labeled including mass, chemical form, and isotopic composition; storage areas are posted with applicable criticality safety limits; methods are established to monitor the presence and effectiveness of credited neutron absorbers; access to fissionable material handling areas is controlled, and fissionable material handler qualification is verified.

- **Planned Response to Nuclear Criticality Accidents:** The installation of a CAAS implies a non-trivial risk of a criticality accident. When present, a CAAS should be supported by documented justification and documented emergency plans and procedures. Conversely, when documentation justifies the absence of a CAAS then emergency plans and procedures are likely unjustified. Criticality accident detectors are capable of detecting the minimum accident of concern; the criticality accident alarm system (CAAS) is designed in such a way as to minimize false alarms; detector placement criteria for all permanent and temporary detectors is documented; a configuration management system is in place to assure the ongoing functionality of the CAAS; the CAAS can alarm appropriate areas of the facility by either audible or visible means; emergency response procedures for criticality accidents are in place; personnel are trained to recognize alarms and in evacuation procedures; evacuation routes and assembly points are identified; procedures for accounting for personnel are in place; criticality accident drills are conducted at least annually and are as realistic as practicable; advance arrangements are in place for the treatment of exposed and contaminated individuals; radiation monitoring equipment is available to response personnel; radiation monitoring personnel are trained; and, emergency procedures address re-entry of facilities and the membership of re-entry teams.

**DOE-STD-1158-2010**

## CONCLUDING MATERIAL

| **Review Activity:** | | **Preparing Activity:** |
|---|---|---|
| DOE | Field and Operations Offices | NNSA/SC |
| HSS | | |
| EH | Idaho | Project Number: |
| EM | Oak Ridge | SAFT-0130 |
| NE | Richland | |
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| RW | | |
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**Site Offices:**

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| 3a. Name of Submitting Organization | 4. Type of Organization (Mark one)<br>☐ Vendor<br>☐ User<br>☐ Manufacturer<br>☐ Other (Specify): |
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5. Problem Areas (Attach extra sheets as needed.)

a. Paragraph Number and Wording

b. Recommended Wording

c. Reason/Rationale for Recommendation

6. Remarks

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