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Rev. 0

Assessment Plan for the BHI Criticality Safety Program

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ACRONYMS

AB	Authorization Basis
ANS	American Nuclear Society
ANSI	American National Standards Institute
BHI	Bechtel Hanford, Inc.
BLAN	Bechtel Local Area Network linking computers
CCN	Correspondence Control Number
CE	Criticality Evaluation
CPP	Criticality Prevention Posting
CSE	Criticality Safety Evaluation
CSP	Criticality Safety Program
D&D	Decontamination and Decommissioning
DE	Design Engineering
DIS	Document and Information System
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
EDPI	Engineering Department Project Instruction
ERC	Environmental Restoration Contractor
HGET	Hanford General Employee Training
HVAC	Heating, Ventilating, Air Conditioning
ISMS	Integrated Environment, Safety, and Health Management System
KENO	monte carlo computer code from Oak Ridge
LACEF	Los Alamos Critical Experiments Facility
LANL	Los Alamos National Laboratory
MCNP	monte carlo computer code from Los Alamos
MOC	Memorandum of Change
NCS	Nuclear Criticality Safety
NCSA	Nuclear Criticality Safety Alternate in training
NCSE	Nuclear Criticality Safety Engineer
OJT	On the Job Training
POD	Plan-of-the-day
RAR	Removal Action Report
RCT	Radiological Control Technician
S/M&T	Surveillance Maintenance and Transition
SSHASP	Site Specific Health and Safety Plan
SSWMI	Site Specific Waste Management Instruction
TSR	Technical Safety Requirement
UNM	University of New Mexico
USQD	Unreviewed Safety Question Determination
WP	Work Package

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	millimeters	0.039	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
cups	0.24	liters	liters	0.264	gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerel	0.027	picocuries

1.0 PURPOSE

The purpose of this document is to provide a plan for ongoing assessments of the Bechtel Hanford, Inc. (BHI) criticality safety program (CSP). This assessment plan will be used to evaluate whether the BHI criticality safety program meets the requirements of ANSI/ANS-8.19, *Administrative Practices for Nuclear Criticality Safety* (both 1984 and 1996 versions), as well as related ANSI/ANS-8 series standards. These standards represent the best practices for criticality safety programs and are mandatory under U.S. Department of Energy (DOE) Order 5480.24 and its successor DOE O 420.1. The assessment plan focuses on (1) current work scope, plan, and program; (2) a look back at events (e.g., occurrence reports) that have occurred since the previous assessment to determine if the events were handled properly; (3) a look back at audits and assessments since the previous assessment to see if corrective actions were taken and if the actions were effective in preventing recurrence; and (4) a determination of whether the BHI criticality safety program is adequate.

2.0 APPROACH AND ASSESSMENT PERIOD

The BHI assessments will address the ANSI/ANS-8.19 criteria stated in *Review Plan for DOE Contractor Criticality Safety Programs*, OPE-AM-99-031, dated July 15, 1999 (DOE 1999). The lines of inquiry that were suggested in this DOE review plan from the Office of Nuclear and Facility Safety, but as modified appropriately for BHI, will be used by the BHI Nuclear Criticality Safety Engineer for self-assessments and may be used by other assessors.

Quoted criteria that differ between the 1984 and 1996 versions of ANSI/ANS-8.19, *Administrative Practices for Nuclear Criticality Safety*, are shown using highlight/strikeout notations in the text.

3.0 REVIEW REQUIREMENTS

3.1 MANAGEMENT RESPONSIBILITIES

This section will be aligned primarily to the functions of BHI Management, Design Engineering and other components located in the 3350 George Washington Way Building.

Criteria: Management shall accept overall responsibility for safety of operations. Continuing interest in safety should be evident. (ANSI/ANS-8.19, Section 4.1)

- Does BHI Management (functional up through the BHI President) accept responsibility for criticality safety of operations?

Criteria: Management shall formulate nuclear criticality safety policy and make it known to all employees involved in operations with fissile material. Distinction may be made between shielded and unshielded facilities, with appropriate criticality controls in all cases. (ANSI/ANS-8.19, Section 4.2)

- Does BHI have a written criticality safety policy?
- How is the BHI criticality safety policy communicated to employees?

Criteria: Management shall assign responsibility and delegate commensurate authority to implement established policy. Responsibility for nuclear criticality safety should be assigned in a manner compatible with that for other safety disciplines. Each individual, regardless of position, shall be made aware that nuclear criticality safety in his work area is his responsibility. (ANSI/ANS-8.19, Section 4.3)

- Are the roles and responsibilities of the BHI Nuclear Criticality Safety (NCS) Staff (i.e., Nuclear Criticality Safety Engineer and Nuclear Criticality Safety Alternate) documented?

- Are the roles and responsibilities of the NCS Manager and Organization documented, if applicable?

- Is BHI Engineering Management assigned responsibility for criticality safety?

- Has BHI assigned responsibility for oversight of the NCS program?

Criteria: Management shall provide personnel familiar with the physics of nuclear criticality and with associated safety practices to furnish technical guidance appropriate to the scope of operations. This function should, to the extent practicable, be administratively independent of operations. (ANSI/ANS-8.19, Section 4.4)

- Does BHI have sufficient funding to assure support by NCS Staff as needed?

- Does BHI Management provide discretionary funding for training and professional development for the NCS Staff?

- Does the NCS Staff have unilateral, unscheduled access to the facility and operations personnel?

- Does BHI have a plan or policy to assure the NCS Staff is familiar with fissile operations?

- Does BHI issue requirements for the qualification and training of NCS Staff, including subcontractors?

- Is the BHI NCS Staff administratively independent of operations?

- Do all members of the NCS Staff have appropriate formal education and experience?

Criteria: Management shall establish a way to monitor the nuclear criticality safety program. (ANSI/ANS-8.19, Section 4.5)

- Who is responsible for monitoring the criticality safety program?
- 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 BHI Management maintain awareness of criticality safety deficiencies by using a corrective action tracking system?
- Is there a program or procedure for trending deficiencies in the criticality safety program?
- Does BHI perform assessments of compliance to operating procedures?
- Does BHI assess implementation of conduct of operations?
- How are NCS funding levels proposed and approved?
- How does BHI Management determine that funding for NCS is sufficient and is there a mechanism for adjusting the funding during the fiscal year?

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

- Does BHI Management participate in review teams or committees to assess facility criticality safety programs?
- Does BHI Project Management routinely audit operations for compliance to criticality safety requirements?
- Does BHI Facility Management routinely audit operations for compliance to criticality safety requirements*?*
- Does BHI perform self-assessments of their NCS Staff and program?

Criteria: Management may use consultants and nuclear criticality safety committees in order to achieve the objectives of the nuclear criticality safety program. (ANSI/ANS-8.19, Section 4.7)

- Does BHI utilize a Nuclear Criticality Safety Committee to assist in monitoring and improving the criticality safety program?

- If a Nuclear Criticality Safety Committee is used, do they report directly to the Senior Management? Are the findings from the Nuclear Criticality Safety Committee, or equivalent, entered into a tracking database and corrective actions implemented?

- Are outside consultants utilized to provide an independent viewpoint on the overall criticality safety program?

3.2 SUPERVISORY RESPONSIBILITIES

This Section will be aligned primarily to reflect various Project and Operations responsibilities.

Criteria: Each supervisor shall accept responsibility for the safety of operations under his control. (ANSI/ANS-8.19, Section 5.1)

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

Criteria: Each supervisor shall be knowledgeable in those aspects of nuclear criticality safety relevant to operations under his control. Training and assistance should be obtained from the nuclear criticality safety staff. (ANSI/ANS-8.19, Section 5.2)

- Do Operations Supervisors formally review credible process upsets and criticality accident scenarios analyzed by the NCS Staff during development of CSEs (Criticality Safety Evaluations)?

- Do Operations Supervisors understand the underlying assumptions in CSEs that involve configuration of equipment, facility modifications, isotopic composition, etc.?

- Is the NCS Staff requested to provide NCS training to Operations Supervisors?

- Do Operations Supervisors know the safety basis for the criticality controls for their operations?

- Does the NCS Staff provide advice and assistance to Project Management regarding implementation of NCS controls?

Criteria: 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. Guidance for a criticality safety training program may be obtained from "American National Standard Training for Nuclear Criticality

Safety," ANSI/ANS-8.20-1991. Records of training activities and verification of personnel understanding shall be maintained. (ANSI/ANS-8.19, Section 5.3)

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

- Do supervisors provide job specific training on procedures that may impact NCS?
- Are walkthroughs and dry-runs provided on procedures that may impact NCS?
- Do pre-job briefs cover criticality controls specific to the operations at hand?
- Do plan-of-the-day meetings address criticality safety related topics like work restrictions due to criticality safety infractions, availability of new procedures and postings, need for NCS Staff participation, results of recent criticality safety assessments/surveillances, etc.?
- Are supervisors cognizant of training records and status of training requirements 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 that may impact NCS, and to criticality safety postings?
- Can supervisors and operators answer questions about the basic criticality controls for their operations?
- Can supervisors generally describe the contingencies and controls for the contingencies for their operations including credited engineered features and key facility assumptions, if any?
- Do supervisors ensure that personnel have demonstrated an understanding of modified or revised procedures that may impact NCS, and criticality safety postings prior to authorizing work?
- Are there records of job specific training on procedures that may impact criticality safety and on criticality safety postings?
- Do supervisors request assistance from the NCS Staff to provide training for operations personnel?
- Do firefighters receive criticality safety training?
- Are firefighters aware of any moderator-controlled areas or processes?

Criteria: 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 operations shall be a continuing supervisory responsibility. (ANSI/ANS-8.19, Section 5.4)

- Are all fissile 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, CSEs, and postings are used for operations?
- How does the Operations Supervisor know when to authorize work after all NCS requirements have been met after modifications to the existing set of controls/procedures?
- Does a clear, unambiguous link between the CSE, 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 all procedure modifications?

Criteria: 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)

- Are there procedures or mechanisms in place and effective to ensure that modifications to equipment and/or processes result in a review of the applicable CSE-procedure-posting set prior to implementing the modification?
- Are there documented surveillances or methods that ensure that new or modified operations conform to applicable CSEs-procedures-postings?
- Is there 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-procedures-postings, and that no criticality infraction will result from startup?

Criteria: Each supervisor shall require conformance with good safety practices including unambiguous identification of fissile materials and good housekeeping. (ANSI/ANS-8.19, Section 5.6)

- Are stored, empty containers labeled as such?

- Are gloveboxes with criticality drains free of loose debris that could potentially clog the drain?

- Is fissile material stored in approved containers?

- Prior to beginning work at a workstation, is there a procedure to verify compliance with criticality safety requirements?

- Is there evidence of fissile material holdup in gloveboxes?

- Are criticality drain liquid traps monitored for adequate liquid levels periodically?

3.3 NUCLEAR CRITICALITY SAFETY STAFF RESPONSIBILITIES

Criteria: 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)

- Does the NCS Staff provide design input for all new or modified equipment that may affect criticality safety?

- 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: The staff shall maintain familiarity with current developments in nuclear criticality safety standards, guides, and codes. Knowledge of current nuclear criticality information should be maintained. (ANSI/ANS-8.19, Section 6.2)

- Does the NCS 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.?

- Does the NCS Staff maintain verified and validated computational techniques for performing CSEs for the site?

- Does the NCS Staff participate in professional development activities such as ANS Standards Committees, Nuclear Criticality Technology & Safety Project Workshops, ANS Meetings, LANL/LACEF courses, UNM courses, etc.?

- Is there a training and qualification program for the NCS Staff? Are all the members of the NCS Staff qualified?

- Does the NCS Staff have a working knowledge of criticality safety related standards, guides, and codes?

Criteria: The staff should consult with knowledgeable individuals to obtain technical assistance as needed. (ANSI/ANS-8.19, Section 6.3)

- Does a synergistic interaction exist among the NCS Staff assigned to specific facilities and the remainder of the BHI NCS Staff?

- Does the NCS Staff consult with offsite criticality safety experts periodically?

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

- Does the NCS Staff observe fissionable material handling and processing operations?

- Are members of the NCS Staff knowledgeable of credible abnormal process upsets applicable to facility operations?

- Does the NCS Staff attend operations planning meetings for new or restarted processes?

- Does the NCS Staff have access to and familiarity with fissionable material operating procedures?

- Does the NCS Staff attend pre-job briefs and plan-of-the-day meetings?

- Does the NCS Staff maintain familiarity with reports of deviations from expected process conditions even if these deviations do not result in a criticality infraction?

Criteria: The staff shall assist supervision, on request, in training personnel. (ANSI/ANS-8.19, Section 6.5)

- Does the NCS Staff participate in training personnel?

- Is the training documented?

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

Criteria: The 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)

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

- Are corrective actions developed for deficiencies?

Criteria: The staff shall examine reports of procedural violations and other deficiencies for possible improvement of safety practices and procedural requirements, and shall report their findings to management. (ANSI/ANS-8.19, Section 6.7)

- Are deficiencies identified as criticality safety infractions reviewed by the NCS Staff?

- Does the NCS Staff formally report findings and recommendations to Facility Management?

- Are lessons learned developed and recommendations to prevent recurrence made to Facility 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?

- Are lessons learned from other facilities reviewed by the NCS Staff for potential application at the facilities?

3.4 OPERATING PROCEDURES

Criteria: The purpose of written operating procedures is to facilitate and to document the safe and efficient conduct of the operation. Procedures should be organized for convenient use by operators and be conveniently available. They should be free of extraneous material (ANSI/ANS-8.19, Section 7.1)

- 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?

Criteria: Procedures shall include those controls and limits significant to the nuclear criticality safety of the operation. They should be such that no single, inadvertent departure from a procedure can cause a criticality accident. (ANSI/ANS-8.19, Section 7.2)

- Are criticality controls included in operating procedures?

- Are the criticality controls clearly identified as important to safety?

- Is there a clear, unambiguous link between criticality controls in procedures and their parent CSE?

- Does BHI have a formalized process for determining which controls are incorporated in procedures?

- Do pre-fire plans incorporate criticality safety controls?

- Are criticality related instructions in pre-fire plans and firefighting procedures practical under actual conditions of responding to fires?

Criteria: Supplementing and revising procedures as improvements become desirable shall be facilitated. (ANSI/ANS-8.19, Section 7.3)

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

- 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: New or revised procedures that have an impact upon nuclear criticality safety shall be reviewed by the nuclear criticality safety staff. (ANSI/ANS-8.19, Section 7.5)

- Do new or revised procedures receive review by the NCS Staff?

- Is there a mechanism for resolving conflicting comments from the NCS Staff and the other reviewers?

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

- 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 CSE?
- 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 all the controls necessary for criticality safety included in postings?
- 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?

Criteria: Deviations from operating procedures and unforeseen alterations in process conditions that affect nuclear criticality safety shall be reported to management, investigated promptly, corrected as appropriate, and documented. Action shall be taken to prevent a recurrence. (ANSI/ANS-8.19, Section 7.7)

- How are infractions graded?
- Are the contingencies and barriers for a given operation readily available to the NCS Staff investigating potential infractions?
- Do procedures exist to upgrade the assigned severity level of infractions due to adverse trends?
- Do procedures exist to upgrade the assigned severity level of infractions due to the magnitude of the decrease in the margin of subcriticality?
- Do operators immediately stop work, leave the immediate vicinity, notify supervision, post the area, and contact the NCS Staff promptly when a potential infraction is identified?
- Does the NCS Staff respond to the scene of a potential infraction?

- Are the responsibilities defined for responding to a potential infraction?

- Does the NCS Staff participate in management critiques of infractions, assigning levels of infractions, 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 line (Facility or Project) 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 all criticality infractions, regardless of severity, documented?

Criteria: 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. These reviews shall be conducted, in consultation with operating personnel, by individuals who are knowledgeable in criticality safety and who, to the extent practicable, are not immediately responsible for the operation. (ANSI/ANS-8.19, Section 7.8)

- 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 that could adversely affect criticality safety, such as movements of criticality detectors, installation of new equipment, inoperable emergency annunciators, etc.?

- Do personnel with NCS experience and knowledge of the operations perform the reviews?

- Do the reviews examine CSEs to verify that changes to the process have not compromised criticality safety?

- Are the results of the review reported to BHI Senior Management as well as Facility and Project 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?

- Do annual reviews of operations look at all the elements of the criticality safety program affecting operations?

3.5 PROCESS EVALUATION FOR NUCLEAR CRITICALITY SAFETY

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

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

- Are natural phenomena hazards, especially seismic, considered in developing criticality accident scenarios?

- Are firefighting scenarios considered (i.e., addition of moderator, displacement of fissile material in water streams, etc.)?

- Do the contingencies credited represent events that are at least unlikely and incorporate lessons learned from previous process upsets and infractions of NCS limits?

- Are the contingencies to be evaluated jointly developed by the NCS Staff, responsible operations personnel, and responsible support engineering organizations?

- Are all credible process upsets considered and either controlled or dispositioned appropriately?

- Are the CSEs performed in a timely fashion?

- Do formalized procedures exist for generating CSEs?

- Does NCS Staff familiar with the facility and operations under consideration perform the CSEs?

- 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?

- Does the NCS Staff have access to archived CSEs as reference?

- Do criteria and procedures exist to determine the magnitude of process changes that can be implemented without revising the CSE?

- Does the NCS Staff work as a team with operations to develop credible accident scenarios and controls?

Criteria: The nuclear criticality safety evaluation shall determine and explicitly identify the controlled parameters and their associated limits upon which nuclear criticality safety depends. The effect of changes in these parameters, or in the conditions to which they apply, shall be understood. (ANSI/ANS-8.19, Section 8.2)

- Are controls developed in CSEs for each contingency?

- Are controlled parameters, contingencies, and credited barriers explicitly documented?

- Do CSEs identify those controls that are to be included in procedures and those that should be included in postings?

Criteria: 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)

- Do CSEs conform to DOE-STD-3007-93, "Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Nuclear Facilities"?

- Do CSEs contain a system/process description with enough detail for an independent reviewer to understand the system/process sufficiently to judge the results of the criticality safety analysis?

- Is there a change control and document control system in place for CSEs?

- Are internal memoranda used to communicate limits and controls in place of formal evaluations?

- Are temporary limits and evaluations (i.e., those that expire after a specified period) used?

- Are all assumptions fully documented in CSEs?

- Can CSEs be read and understood by the line supervision?

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

- Do all CSEs receive an independent technical peer review before approval for use?

- 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?

3.6 MATERIALS CONTROL

Criteria: The movement of fissile materials shall be controlled as specified in documented procedures. (ANSI/ANS-8.19, Section 9.1)

- Are procedures in place to control the movement of fissile material between facilities?
- Are procedures in place to control movement of fissile material within a single facility?
- Are procedures in place to control transfers of fissile material 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?
- Are material balance checksheets or equivalents used to maintain a running log of fissile mass contained in gloveboxes, storage arrays, etc.?

Criteria: Appropriate material labeling and area posting shall be maintained, specifying material identification and all limits on parameters that are subject to procedural criticality control. (ANSI/ANS-8.19, Section 9.2)

- Do fissile material labels contain all the information necessary to determine compliance to applicable NCS controls such as fissile mass, cladding, moderators, chemical form, shape, isotopic composition, etc.?
- Are all fissile material storage areas posted as such with criticality controls clearly identified?
- Can the mass and location of all fissile materials in a glovebox be determined by inspection of logs posted on the glovebox?

Criteria: If reliance for criticality control is placed on neutron absorbing materials that are incorporated into process materials or equipment, procedural control shall be exercised to maintain their continued presence with the intended distributions and concentrations. (ANSI/ANS-8.19, Section 9.3)

Any use of borosilicate Raschig rings shall conform to the requirements of ANSI/ANS-8.5, “Use of Borosilcate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material.”

- 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?

- Are practices dealing with fixed neutron absorbers generally consistent with ANSI/ ANS-8.21, "Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors"?

Criteria: Access to areas where fissile material is handled, processed, or stored shall be controlled. (ANSI/ANS-8.19, Section 9.4)

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

- Does Facility Management verify the qualification of personnel who handle fissile material before authorizing work?

Criteria: Control of spacing, mass, density, and geometry of fissile material shall be maintained to assure subcriticality under all normal and credible abnormal conditions. (ANSI/ANS-8.19, Section 9.5)

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

- Are containers of residue and product fissile material stored in fixed arrays or have engineered spacers attached?

- When administrative spacing controls are used, has the CSE demonstrated that the system will remain subcritical in a seismic event?

- Are administrative spacing controls credited as unlikely events in CSEs?

- Where engineered features are credited for criticality control, are inspections conducted to verify they are capable of performing the intended function?

- For solution storage areas are procedures in place to detect concentration and stratification changes in the solution?

- Are fissile solutions periodically monitored for changes in pH?

- Do double-block-and-bleed valve arrangements, or equivalent, where the addition of fissile material is prohibited, protect isolated, inactive fissile solution storage tanks?

- Has the CSE demonstrated that all storage vaults, gloveboxes, and solution storage arrays will remain subcritical under the same design conditions the building/structure is designed to withstand (seismic events, flooding, high winds, etc.)?

- Does fissile material holdup in process vessels, gloveboxes, the HVAC, and other accumulation points present a credible criticality accident scenario?

- Is holdup of fissile material monitored and controlled?

- Will fissile material remain subcritical under credible firefighting scenarios?

3.7 PLANNED RESPONSE TO NUCLEAR CRITICALITY ACCIDENTS

Criteria: Guidance for the use of nuclear criticality accident alarm systems may be obtained from "American National Standard Criticality Accident Alarm System," ANSI/ANS-8.3-1986. Evacuation signals are also addressed in ANSI/ANS-8.3-1986. (ANSI/ANS-8.19, Section 10.1)

- Is there a policy for how 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 and 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 a documented analysis showing that the criticality alarm is audible at all occupied locations subject to an expected dose of 12 Rad in free air?

- 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 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?

- 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: Emergency procedures shall be prepared and approved by management. Organizations, on- and off-site, that are expected to provide assistance during emergencies shall be informed of conditions that might be encountered. They should be assisted in the preparation of suitable emergency response procedures. (ANSI/ANS-8.19, Section 10.2)

- Are emergency procedures available and approved?

- 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?

- Does the NCS Staff have a role in responding to criticality accidents?

- 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?

Criteria: Emergency procedures shall clearly designate evacuation routes. Evacuation should follow the quickest and most direct routes practicable. These routes shall be clearly identified and should avoid recognized areas of higher risk. (ANSI/ANS-8.19, Section 10.3)

- Do emergency procedures designate evacuation routes?
- Are evacuation routes identified and avoid areas of higher risk?

Criteria: Personnel assembly stations, outside the areas to be evacuated, shall be designated. Means to account for personnel shall be established. (ANSI/ANS-8.19, Section 10.4)

- 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?

Criteria: Personnel in the area to be evacuated shall be trained in evacuation methods and informed of evacuation routes and assembly stations. Provision shall be made for the evacuation

of transient personnel. Drills shall be performed at least annually to maintain familiarity with the emergency procedures. Drills shall be announced in advance. (ANSI/ANS-8.19, Section 10.5)

- Are personnel trained to evacuate by the quickest and most direct route?
- Do personnel know where they are to assemble?
- Are criticality drills performed at least annually?
- Are annual criticality drills a TSR requirement?
- 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?
- Will more than one facility go into alarm if a criticality accident occurs?
- Are facility visitors indoctrinated in proper evacuation procedures?
- Is an emergency command center established for criticality accident drills?

Criteria: Arrangements shall be made in advance for the care and treatment of injured and exposed persons. The possibility of personnel contamination by radioactive materials shall be considered. (ANSI/ANS-8.19, Section 10.6)

- 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: Planning shall include a program for the immediate identification of exposed individuals and should include personnel dosimetry. Guidance for dosimetry can be found in "American National Standard Dosimetry for Criticality Accidents," N13.3-1969 (R 1988). (ANSI/ANS-8.19, Section 10.7)

- Do radiation monitoring personnel participate in criticality drills?
- Do radiation monitoring personnel respond to the assembly areas to monitor for radioactive contamination?

Criteria: Instrumentation and procedures shall be provided for the determination of the radiation intensity at the assembly area and in the evacuated area following a criticality accident. Information should be correlated at a central control point. (ANSI/ANS-8.19, Section 10.8)

- Are procedures in place to monitor radiation levels at the assembly areas?
- Are both gamma and neutron detectors available?
- Are radiation monitoring personnel trained in the interpretation of radiation data as it pertains to an ongoing criticality accident?
- Are procedures in place to move personnel from designated assembly areas in the event an unacceptably high radiation field is encountered?
- Are radiation readings reported to the emergency command center?

Criteria: Emergency procedures shall address re-entry procedures and the membership of response teams. (ANSI/ANS-8.19, Section 10.9)

- 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 the types of assignments they will likely be asked to perform and trained in the types of actions they should avoid (i.e., increasing the risk of high exposure of inadvertent actions that could result in re-criticality)?
- Does the incident commander have pre-determined criteria for authorizing re-entry?

4.0 REFERENCES

ANSI/ANS-8.1-1983, *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*, reaffirmed in 1988, American National Standards Institute, New York, New York.

ANSI/ANS-8.3-1986, *Criticality Accident Alarm System*, revised in 1998, American National Standards Institute, New York, New York.

ANSI/ANS-8.5-1986, *Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material*, revised in 1996, American National Standards Institute, New York, New York.

ANSI/ANS-8.7-1975, *Guide for Nuclear Criticality Safety in the Storage of Fissile Materials*, reaffirmed in 1987, American National Standards Institute, New York, New York.

ANSI/ANS-8.19-1984, *Administrative Practices for Nuclear Criticality Safety*, revised in 1996, American National Standards Institute, New York, New York.

ANSI/ANS-8.20-1991, *Nuclear Criticality Safety Training*, revised in 1999, American National Standards Institute, New York, New York.

ANSI/ANS-8.21-1995, *Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors*, American National Standards Institute, New York, New York.

DOE, 1999, *Review Plan for DOE Contractor Criticality Safety Programs*, OPE-AM-99-031, dated July 15, 1999, U.S. Department of Energy, Washington, D.C.

DOE O 420.1, *Facility Safety*, as amended, U.S. Department of Energy, Washington, D.C.

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