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Safe Interim Storage of Spent Nuclear Fuel Criteria and Review Approach Document		
Authorization and Approval	Aleem E. Boatright Acting Director, Office of Nuclear Safety and Environmental Assessments EA-31 Date: August 20, 2020	Lead, Ronald G. Bostic Nuclear Engineer EA-31 Date: August 12, 2020

1.0 PURPOSE

The mission of the U.S. Department of Energy (DOE) Office of Environment, Safety and Health Assessments (EA-30) is to assess the effectiveness of safety and emergency management systems and practices used by line and contractor organizations and to provide clear, concise, rigorous, and independent evaluation reports of performance in protecting workers, the public, and the environment from the hazards associated with DOE activities.

In addition to the general independent oversight requirements and responsibilities specified in DOE Order 227.1A, *Independent Oversight Program*, this criteria and review approach document (CRAD), in part, fulfills the responsibility assigned to EA in DOE O 226.1B, *Implementation of Department of Energy Oversight Policy* to conduct independent appraisals of high consequence activities. This CRAD specifically provides objectives, criteria, and review approaches to assess the safe interim storage of spent nuclear fuel (SNF) at DOE sites.

The CRADs are available to DOE line and contractor assessment personnel to aid them in developing effective DOE oversight, contractor self-assessment, and corrective action processes. The current revision of EA's CRADs are available at http://www.energy.gov/ea/criteria-and-review-approach-documents.

2.0 APPLICABILITY

The following CRAD is approved for use by the Office of Nuclear Safety and Environmental Assessments (EA-31).

3.0 FEEDBACK

Comments and suggestions for improvements on this CRAD can be directed to the Director, Office of Environment, Safety and Health Assessments.

4.0 CRITERIA AND REVIEW APPROACH

The review of Safe Interim Storage of Spent Nuclear Fuel (SNF) will evaluate the adequacy of implementation of hazard controls identified in the safety basis documentation for facilities used for interim storage of SNF, including the continuing validity of key assumptions and initial conditions from hazard and accident analyses related to structures and containment vessels used for interim storage of SNF as they age. Training, qualification, and certification of SNF handlers and supervisors are also included in the scope of this CRAD.

OBJECTIVES

SNF.1: The safety basis identified hazard controls for safe interim storage of SNF are effectively implemented to ensure adequate protection of workers, the public, and the environment from adverse consequences. (10 CFR 830.4(c); 10 CFR 830.201; 10 CFR 830.204; 10 CFR 830.205; 10 CFR 830 Appendix A, §G)

Criteria

1. Technical Safety Requirements (TSR) Limiting Conditions of Operations (LCOs), Specific Administrative Controls (SACs), and design features are implemented to ensure the hazards from stored SNF are adequately controlled. (10 CFR 830.201; 10 CFR 830.204; 10 CFR 830.205; 10 CFR 830 Appendix A, §G)
2. TSR surveillance requirements (SRs) for safety structures, systems, and components (SSCs) used in the interim storage of SNF are appropriately performed to ensure necessary operability and quality is maintained. (10 CFR 830.201; 10 CFR 830 Appendix A, §G.6, Table 4)

Lines of Inquiry

- Are LCOs adequately documented in reviewed and approved work instructions that are consistent with the facility safety basis?
- Can parameters that demonstrate compliance with the safety basis be measured or verified and performance trended?
- Does a walkdown of the safety systems and/or design features support a conclusion that the installed SSCs are consistent with the descriptions and functions provided in the safety basis?

- Are TSR Violations, Out-of-Tolerance Conditions, and Return to Service situations covered by adequate work instructions?
- Are instrumentation and measurement and test equipment for safety systems periodically calibrated?
- What processes are established to ensure proper calibration is maintained for TSR-related measuring devices?
- Are monitoring and test equipment appropriate for the task?
- Are SRs and acceptance criteria adequately documented in reviewed and approved work instructions that are consistent with the facility safety basis?
- Do surveillance and testing of the system demonstrate that all required components within the system are capable of accomplishing their safety functions and continue to meet applicable functional requirements and performance criteria?
- Do surveillance and test procedures confirm that key operating parameters for the overall system and its major components remain within the safety basis and operating limits?
- Are facility personnel knowledgeable of and able to satisfactorily perform TSR-required surveillances and in-service inspections (ISIs)?
- Does the facility have an adequate system for tracking LCO compliance, including scheduling and completing SRs?
- Does documented evidence demonstrate that LCO- and AC-related SRs are completed in a timely manner?
- How have grace periods for SRs been applied? Can grace periods be compounded?
- Do work instructions for SRs describe the limitations beyond which an Out-of-Tolerance condition would exist? How are limitations defined for Planned Out-of-Tolerances?
- Do the surveillance procedures require timely notification to facility management about any failure or discrepancy that could impact operability?
- Do appropriate facility management and cognizant system engineers review the surveillance results and take appropriate action?
- Do maintenance, inspection, testing, and surveillance procedures include limits, precautions, prerequisite conditions, applicable TSRs, acceptance criteria, required data to be recorded, and identify required personnel qualifications?
- Do the SACs appropriately reflect assumptions of facility configuration and human performance of safety functions, operational parameters, and key programmatic elements?
- Is there clear linkage from the SAC implementing procedure(s) to the TSR and its safety function?
- Can the facility operators perform the SAC related task(s) called for within the required timeframe and under the conditions assumed in the safety basis?
- Does the development and implementation of SACs adequately factor in:
  - the level of difficulty of the task(s)
  - operator training and capabilities
  - the design of the equipment
  - adequacy of feedback such as indicators and alarms
  - the time available to perform the task(s) and to recover from errors
  - actual facility conditions and stress levels caused by or complications created by work constraints or the work environment (e.g., donning PPE, obtaining required approvals, security requirements, noise levels, heat/humidity, accessibility, and availability of communications equipment)?
- Has the safety basis adequately documented credited design features that, if altered or modified, could have a significant effect on safe operation, where the safety functions, performance criteria, and periodic inspection requirements are clearly developed and defined?
- Are the credited design features inherently passive (accomplish their function without a change of state) and not subject to significant alteration by operations or by aging?

- Do the design features specify the inherent characteristics or qualities of an object or component required to protect the validity of the DSA accident analysis?
- Are the design lives of the design features known and documented?
- Are safety basis defined surveillance tests and inspections necessary to ensure continued operability of the design features adequately performed and documented?
- Do safety basis and design documents specify ISIs for the design features as expected by DOE-STD-3009-2014 §[5.6 *Design Features*]?
- Are surveillance, test, and inspection procedures executable and adequate to demonstrate the continued operability of design features?
- Are inspections for design features addressed in a configuration management program or a stand-alone ISI program?
- Has the contractor developed and implemented an ISI program to ensure design features (e.g., SNF storage packages) continue to meet their design criteria?
- Does the ISI program for design features have adequate technical details (e.g., specific container design, concrete specifications)?
- Has the ISI program been updated to reflect any design changes to the design features?
- Does the ISI program require evaluating design feature attributes to determine whether the overall storage system can continue to store SNF safely?
- Are the ISI results used to validate the design feature's design life?
- Are there requirements in place to remediate degraded design features and conduct extent of condition reviews?
- Are ISI techniques specified to provide early indications of design feature degradation (e.g., SNF storage system confinement seal failure, loss of venting capability (if present))?
- Is the ISI frequency specified for each design feature (e.g., the SNF package design and SNF content combination)?
- Is the ISI frequency based on the potential failure mechanisms, failure consequences, changing conditions, and design life of design features?
- Do ISI procedures specify techniques to be used and define acceptance criteria?
- Are measurements trended to determine if the design feature is degrading such that the parameters may eventually not meet the acceptance criteria?
- Do ISI procedures address initial response to a design feature failing the inspection acceptance criteria?
- Is there a mechanism used to ensure ISIs are conducted when required, and whether they are consistently being performed on time?

SNF.2: A program for the selection, training, and qualification of facility personnel has been established and effectively implemented to ensure the competency of the personnel who conduct or supervise SNF handling operations. (DOE Order 426.2, Change 1, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities)*

Criteria

1. A systematic approach (e.g., the analysis, development, design, implementation, evaluation process) to training is effectively implemented for the training of SNF handlers and their supervisors. (DOE Order 426.2, Attachment 1, Chapter I, Section 4)
2. Personnel selected for positions that handle or supervise the handling of SNF meet the established minimum education and experience requirements or have properly approved equivalency. (DOE Order 426.2, Attachment 1, Chapter I, Section 3; Chapter II, Section 2)
3. The implementation of qualification/certification (and requalification/continuing training) processes for SNF handlers and their supervisors (as identified in the DOE approved Training and Implementation Matrix (TIM) or Training Program Plan (TPP) ensures that they are competent to

perform operations involving SNF. (DOE Order 426.2, Attachment 1, Chapter I, Sections 5, 6, 7, and 8)

Lines of Inquiry

- Is the DOE approved TIM or TPP consistent with the training program requirements for SNF handlers and their supervisors?
- Does the training and qualification/certification program for SNF handlers and supervisors:
    - Incorporate the task analysis, training development, design, implementation, and evaluation (ADDIE) process?
    - Require certification for fissionable material handlers, and their supervisors?
    - Require timely gap training for safety basis, procedure, and facility changes?
    - Establish a minimum formality for training (e.g., conduct of operations required reading is not creditable training) including approved lesson plans with objectives and learning evaluation?
    - Establish a formal requalification process including examination and operational evaluation or performance demonstrations?
- Do SNF handlers and their supervisors meet the prescribed education, nuclear experience and training requirements or have properly approved equivalency/exceptions, or extensions?
- Are the current safety basis documents, procedures, technical and professional references, DOE orders and guidelines, and industry operating experience used as applicable to establish both initial and continuing training for SNF handlers and their supervisors?
- Does the continuing training program that is established and implemented:
    - Provide needs-based training on a two-year cycle?
    - Include refresher training on "overtrain" tasks, facility and industry events, facility and procedure modifications, retraining addressing task performance deficiencies, and training on infrequently performed tasks?
    - Require periodic examinations to confirm learning and competence
- Is on-the-job training for SNF handlers conducted in realistic conditions and evaluated by qualified OJT instructors?
- Are the DOE-STD-1070-94 periodic evaluations of training and qualification programs performed by the DOE field element and contractor current (three year cycle), performed by qualified evaluators, and scoped to include the facility's training program?
- Does the contractor have a method for formally indicating that a person is qualified as an SNF handler or supervisor and when qualifications expire?
- If control manipulation and/or proficiency requirements are established for SNF handlers and supervisors, are they current? If not current, are the SNF handlers and supervisors removed from certified duties?
- Do extensions of certification for SNF handlers and their supervisors require approval by the DOE head of the field element?

SNF.3: Aging management processes are implemented for interim storage of SNF to ensure SSCs important to safety continue to provide their safety functions throughout the extended service life of the facility. (DOE Order 433.1B, Chg 1, *Maintenance Management Program for DOE Nuclear Facilities*, Attachment 2, Section 2.m)

Criterion

The Nuclear Maintenance Management Program (NNMP) includes processes for conducting inspections to ensure design features within the safety basis can continue to perform their intended safety functions, and to evaluate aging-related degradation and technical obsolescence. (DOE Order 433.1B, Chg 1, *Maintenance Management Program for DOE Nuclear Facilities*, Attachment 2, Section 2.m)

Lines of Inquiry

- Has an aging management program for interim storage of SNF been established and implemented?
- Do aging inspections evaluate degradation of safety function that may have occurred from environmental exposure, radiation, exposure to working fluids, corrosion, stress cracking, pitting, and other degradation mechanisms relevant to the credited safety function?
- Does the NMMP identify the specific SSCs subject to aging management degradation inspections?
- Are defense-in-depth SSCs included in the aging management degradation inspections?
- Are ISIs implemented for safety SSCs susceptible to aging degradation?
- Does the NMMP identify the parameters monitored or inspected for the particular structure and component based on its safety function?
- Has the design life of SSCs been determined?
- Is the basis for SSC design life technically adequate?
- Has an adequate design life extension evaluation been performed? If any remedial or corrective actions were required, have they been implemented?
- Does the facility management implement appropriate guidelines for periodically evaluating the performance of safety concrete structures consistent with National Standards (e.g., ACI 349.3R-02 *Evaluation of Existing Nuclear Safety-Related Concrete Structures* or ACI 365.1R-00 *Service-Life Prediction)?*
- Has a mechanism or process been implemented to track parameters important to service life against design life and trigger action when needed?
- Does the NMMP establish acceptance criteria, against which the need for corrective action will be evaluated, to ensure that the SSCs intended function continues to meet all safety basis requirements?
- Is the periodicity of aging inspections based on an engineering evaluation of the likely degradation mechanisms?
- Does the NMMP define the review process for information received during aging degradation inspections?
- Does the NMMP ensure that preventive maintenance is adequate and that appropriate corrective actions, when required, have been completed and are effective?
- Does the NMMP establish how operating experience of the aging management program, including past corrective actions resulting in program enhancements or additional programs, provides objective evidence to support that the effects of aging will be adequately managed so that the structure and component intended function(s) will be maintained?
- Does the NMMP require that high value components that are approaching end of life are included in a recapitalization requirements program as defined in DOE O 430.1B?
- Have the Time Limited Aging Analyses (TLAAs) been updated to take into consideration extension of facility service life? Have the updates been reflected in the safety basis and impacts on hazard analysis and control selection been evaluated?

REVIEW APPROACH

Record Review:

- Safety basis documents for interim storage of SNF
- Maintenance, inspection and testing, and surveillance procedures
- Documents and drawings for safety SSCs associated with interim storage of SNF
- Operating procedures for safety SSCs associated with interim storage of SNF
- Implementation Verification Review reports
- Surveillance procedure execution records/data sheets

- Implementing procedures for SACs associated with interim storage of SNF
- NNMP description documents
- ISI work instructions
- ISI or surveillance documentation
- Training Implementation Matrix
- Qualification program descriptions for SNF handlers and supervisors
- Assessments of training and implementation, including DOE-STD-1070-94 assessments, by the contractor and DOE
- Training materials for SNF handlers and supervisors
- Continuing training materials for SNF handlers and supervisors
- Qualification and certification records for SNF handlers and supervisors

Interviews:
- Facility Manager
- Operations Manager
- Operators
- Maintenance personnel
- Technicians
- Technical support staff
- Personnel responsible for scheduling and tracking surveillance performance
- Cognizant System Engineer
- Maintenance Manager
- SNF handlers
- Supervisors of SNF handlers

Observations:
- Walkdown of design features and safety systems for interim storage of SNF
- Walkdown of procedures accompanied by responsible facility personnel
- Observation of procedures being performed
- Table-top exercises
- Observation of SRs procedure performance
- Performance of ISIs
- Training sessions for SNF handlers/supervisors
- Qualification program activities for SNF handlers or their supervisors
- SNF handling operations