INSPECTION PROCEDURE 88015

HEADQUARTERS NUCLEAR CRITICALITY SAFETY PROGRAM

PROGRAM APPLICABILITY: 2600 and 2630

88015-01 INSPECTION OBJECTIVES

The objectives of the Headquarters Nuclear Criticality Safety (NCS) Program inspection procedure are to ensure that:

01.01 The regulatee maintains an effective nuclear criticality safety program that has established and maintains configuration control over all facility and process operations that affect NCS.

01.02 The regulatee obtains NCS advice from an NCS function (NCSF) that acts independently from the production function.

01.03 The regulatee avoids undue risk of inadvertent criticality, i.e., the regulatee's activities are conducted safely.

88015-02 INSPECTION REQUIREMENTS

02.01 Management and Administrative Practices for Nuclear Criticality Safety

a. Objectives

1. Verify* that management has established and communicated an adequate NCS policy for workers and plant organizations.

2. Verify that management, supervisors, and operators are responsible for and are trained in NCS.

3. Verify that a means for monitoring the effectiveness of the NCS program has been established.

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* See Section 03.00 (d)(e) for special definitions and expectations of the terms "verify" and "confirm" used in this procedure.

4. Verify that an NCS technical function independent of operations has been established.

b. Requirements

1. Plant Policy for Nuclear Criticality Safety. Every two years, verify by observations, document review, and discussions that written plant policy describes each employee's authority and responsibility for nuclear criticality safety, including the shut down of operations and the authority to restart operations following such a shutdown.

   During every inspection, verify that the policy defines organizational authority and responsibility for nuclear criticality safety. Through discussion with a sampling of line managers, verify that line managers are trained and know their responsibilities under this policy.

2. Plant Manager's Responsibility for Nuclear Criticality Safety. During every inspection, verify by observation, document review, and discussion that the plant manager has empowered every employee and plant department with the authority and responsibility to ensure nuclear criticality safety. Verify that the plant manager accepts overall responsibility and continues to show interest in NCS. Verify that the plant manager holds his or her staff accountable for NCS.

3. Operations Managers' Responsibilities for Nuclear Criticality Safety. During every inspection, verify that selected line managers accept their NCS responsibilities and carry out their responsibility for nuclear criticality safety. Verify by observation, discussion, and document review that authorities and responsibilities have been conveyed to individuals in each manager's organization. Verify and evaluate managements involvement in ensuring the effectiveness of the NCS program to avoid undue risk of nuclear criticality.

4. Operations Supervisors' Responsibilities for Nuclear Criticality Safety. During every inspection while inspecting processes with new NCS evaluations, [see 02.02(b)(3)] conduct discussions with select operations supervisors to verify their understanding of their responsibility for nuclear criticality safety. Verify that the supervisors participate in the development of operating procedures; provide training; require that operators have an understanding of procedure and safety considerations to do their duties without undue risk; confirm compliance with NCS specifications; and require conformance with good safety practices. Assess selected supervisors' understanding of NCS requirements about operations under their control. To verify supervisory acceptance of responsibility for NCS, evaluate selected supervisors' assessment of the effectiveness of NCS training.

5. Nuclear Criticality Safety Function's Responsibilities. Every two years, verify by discussions with plant,

operations, and NCS management and by review of organizational documents that the NCSF reports to senior plant management independent of operations management.

During every inspection, verify by discussions with operations and NCS staff that the NCSF provides technical guidance on all changed or new special nuclear materials (SNM) operations and procedures, including design; and on inspection, audit, and investigation results. Verify that the NCSF maintains familiarity with current safety standards, guides, and codes; maintains familiarity with all plant operations; and provides information in the NCS training programs. Verify that the NCS staff is trained to do their function.

6. Support Function Management Responsibilities for Nuclear Criticality Safety. Every two years, verify support function management's involvement in ensuring the effectiveness of the NCS program to avoid undue risk to nuclear criticality safety, and evaluate selected managers' knowledge of, and actions taken, to monitor the nuclear safety program.

7. Management Involvement in Providing Written Administrative and Operating Procedures. Every two years, verify by observation, review of documents, and discussion that management requirements exist for administrative procedures to define the interface between operations, nuclear criticality safety, and other operations support functions. Verify that such procedures do exist and are adequate to ensure that NCSF is consulted before a change or new activity that could affect NCS is initiated. Verify that NCSF has administrative procedures that define how NCS limits and controls will be developed within the NCSF.

8. Nuclear Criticality Safety Training. Every two years, verify by discussion that management has established NCS requirements for initial and refresher training for all fissile material handlers, their supervisors and managers, support function engineers and managers, and the NCSF staff.

9. Nuclear Criticality Safety Advisory Committee. Every two years, verify that the plant manager has chartered and maintains a committee to advise the manager on NCS matters. Verify that the committee is staffed by qualified members and is functioning effectively. Verify that plant management has received and tracked recommendations from the committee and has taken action on recommendations accepted or has documented justification for nonacceptance.

02.02 Nuclear Criticality Safety Function

a. Objectives

1. Verify that the administrative procedures adequately implement the NCS program described in plant documents, including the license or certificate.

2. Verify that procedures exist for requiring NCSF staff to evaluate each proposed process change and to establish appropriate NCS limits for controlled parameters and NCS controls process conditions.

3. Verify that NCS evaluations are based on validated methods.

4. Verify that NCS evaluations identify all criticality scenarios and establish NCS limits for controlled parameters and NCS control systems to prevent criticality.

5. Verify that the NCS evaluations are adequate.

6. Verify that the NSCF is independent from the production function.

b. Requirements

1. Administrative Procedures. Every two years, verify by observation, discussion and document review that the administrative procedures are adequate for the implementation of the NCS program.

   During every inspection, verify that any changes to the NCS administrative procedures for the NCS program are appropriate adequate and effectively implemented.

2. Qualification of Staff. Every two years, verify by discussion and document review that the NCS analysts and the senior reviewers are qualified to do their respective safety functions.

   During every inspection, verify by discussion and document review that only qualified staff performed safety functions for the establishment of new safety analyses and reviews of new operating procedures. [See 02.02(b)(3).]

3. Validation of Methods. For all safety evaluations established (new or modified) since the last headquarters inspection, verify by discussion and document review that the regulatee used only validated analytical methods. For analytical methods identified in the license or certificate and used since the last inspection, verify that the methods were not modified after the validation process was completed. For new analytical methods, verify that the methods were validated in an appropriate manner and that a validation report was written and is being maintained.

If there are not sufficient new evaluations to review, select several older evaluations from higher risk areas of the plant for verification during the inspection.

4. Nuclear Criticality Safety Evaluations. For each fissile unit operation modified since the last inspection and for each new operation [See 02.02(b)(3)] verify by document review, observation, and discussions that:

   (a) An NCS evaluation exists for the revised or new process and that it accurately reflects the existing plant configuration.

   (b) Each process evaluation identifies and incorporates realistic or conservative assumptions for the process description and conditions.

   (c) The evaluation provides complete accident pathway analyses for contingencies that could lead to nuclear criticality. Verify that the operations staff participates in the identification of contingencies. Verify that the method(s) to identify the contingencies is (are) specified in the evaluation.

   (d) Where possible, two independent NCS control systems have been established for each accidental criticality pathway. Verify that the NCS control systems ensure that at least two unlikely, independent, and concurrent changes in process conditions must occur before criticality is possible. Verify that passive engineered controls are selected over active engineered controls, when feasible, and that active engineered controls are selected over administrative controls, when feasible.

   (e) The controlled parameters and their associated NCS limits are identified. Verify that the NCS limits and NCS control systems are adequate to control the risk of nuclear criticality.

   (f) The evaluation has sufficient detail and clarity to allow an independent assessment.

5. Independent Reviews of Nuclear Criticality Safety Evaluations. During each inspection, for the safety evaluations identified in 02.02(b)(3), verify by discussion and document review that the independent reviews were completed and were documented. Verify that the reviews were done independently, that the reviewed material is identified in the documentation, and that the reviews provide assurance that the initial analyses were realistic. Verify that the NCS limits for controlled parameters and NCS control systems were discussed with operating management and that operating management has agreed to and are implementing the limits and controls.

6. Safety Criteria. During each inspection, for the safety evaluations identified in 02.02(b)(3), verify by discussion and document review that the specified NCS limits on controlled parameters and NCS control systems assure subcriticality by providing a defense-in-depth (double contingency practice) for each identified potential pathway for nuclear criticality. For the same analyses, verify that the analyses show that margins of safety on the NCS limits satisfy the plant and license or certificate requirements. Verify that the reliance is placed on passive or active engineered NCS controls, when practicable, or that reliance on administrative controls is justified in writing.

02.03 Plant Activities

a. Objectives

1. Verify by observation and discussion that assumptions and analyses for the NCS evaluation are consistent with the process and operations, and all NCS limits and control systems are adequate for NCS.

2. Verify that NCS limits and control systems identified in the new or revised safety analyses are in place and are being followed.

b. Requirements

1. Plant Tour. Tour the facility to maintain familiarity with the entire process. Confirm that NCS practices observed seem satisfactory.

2. Observe Operations/Implementation of New Safety Evaluations. During each inspection, only for the new safety analyses identified in 02.02(b)(3), verify by observations, discussions, and document review that management functions (establishment of written procedures, operator training, and posting of limits) and plant activities are being conducted as described in the requirements in the safety evaluation and the license or certificate. This verification effort includes the physical presence of NCS control systems as described in the new or revised safety evaluation; the as-built inspection documentation by the regulatee; control of the process environment; establishment of procedures for operations, maintenance and surveillance; postings and labeling requirements; training of staff for new NCS requirements; and provisions for inspections and audits of new requirements.

02.04 Configuration Control Program for Nuclear Criticality Safety

a. Objectives

1. Verify that the program requires maintenance of documentation defining the system configuration, operations, and maintenance.

2. Verify that the program requires that the NCS staff provide guidance for process design, NCS limits and controls for operating procedures, and operator training.

3. Verify that the program requires the completed NCS evaluations and implementing procedures be included in the configuration control system.

4. Verify the engineering control notices are incorporated into NCS evaluations within an established time period.

b. Requirements

1. Program. Every two years, verify by discussion, document review, and observation that the regulatee has a management system for generation and retention of documents that define the establishment and maintenance of the plant NCS bases. Verify that the system simplifies revising procedures and requires that supervisors participate in the development of procedures. Verify that the program defines the interaction between NCSF, operations, engineering, maintenance and other support functions. Verify that the documents define the site design bases; facility design bases; unit process descriptions, including Process and Instrumentation Drawings (P&IDs) and process materials flows; floor plans; controls for movement of SNM; postulated pathways to criticality accidents (hazards analyses); safety analyses for all pathways including safety limits and controls systems to prevent the accidents; maintenance requirements for the safety control systems; training requirements for the safety limits and control systems; maintenance, calibration and surveillance for safety control systems; and inspection and audit requirements.

For those plant configurations that are modified in accordance with approved engineering change notices, ensure that the configuration control system identifies NCS evaluations and procedures that may be affected.

2. Nuclear Criticality Safety Evaluations. For each fissile unit operation modified since the last inspection and for each new operation, verify by document review, observation, and discussions that an NCS evaluation is maintained within the configuration control system for the revised or new process.

3. Maintenance, Calibration, and Surveillance of Safety Systems. Every two years, verify by observation, discussion, and document review that the configuration control program provides for the inclusion of the NCS-engineered control systems to be entered into the maintenance program; that the maintenance program requires the establishment of schedules for preventive maintenance, calibration, and periodic surveillance as required by the reliability evaluation section of the safety evaluation; and that replacement parts for NCS control systems are controlled and have been approved for use in the safety analyses.

   During every inspection, for each safety evaluation identified per 02.02(b)(3) for review, verify that the maintenance schedules are consistent with the safety analyses.

4. Procedures. During each inspection, for each safety evaluation reviewed per 02.02(b)(3), verify by observation, discussion, and document review that the operating procedures contain the NCS limits for controlled parameters, prescribe the NCS control systems, and identify the requirements for safe operation of active engineered and administrative NCS control systems. Verify that, as appropriate, maintenance, calibration, and surveillance procedures are in place. Verify that NCS training, inspection, and audit requirements have been documented and are in effect.

5. Configuration Control Change Procedure. Every two years, verify by observation, discussion, and document review that the process for making changes to the configuration control program has been documented. Review the procedure to verify that the procedure provides for the establishment and retention of records for evaluations reviewed per 02.02(b)(3).

   During each inspection, for safety analyses established since the last inspection, verify that the change procedure for the configuration control program has been followed.

6. Configuration Control Training. Every two years, verify by dis-cussion, observation, and document review that the content of the performance-based training for the configuration control program has been established and is adequate for all employees. Verify by discussion with selected managers, supervisors, and operators that the training has been effective.

02.05 Nuclear Criticality Safety Change Control

a. Objectives

1. Verify that a change control process exists and is adequate.

2. Verify that the change control process ensures that changes potentially affecting NCS are identified, reviewed, and evaluated.

3. Verify that the change control program ensures that process and control systems were consistent with NCS evaluations before commencement of operations.

b. Requirements

The verification requirements in this section of the inspection procedure should focus on the new or modified NCS evaluations identified in 02.02(b)(3).

1. Documentation. Every two years, verify by observation, discussion, and document review that written procedures exist for NCS change control. Verify that the procedures identify the process for effecting change, including responsibility for operations to initiate a change request, responsibility for preparing documents for process description, NCS limits and controls, maintenance and surveillance procedures, pre- and post- inspection and verification procedures and records, postings, and future inspection and audit requirements.

2. Verification. During each inspection, verify by observation, discussion, and document review that an appropriate change control program is in place and is effective for analyses established since the last inspection. Verify that pre-operational inspections were conducted for changed operations.

02.06 Operating Procedures

a. Objectives

1. Verify that a program exists to ensure that written procedures, including NCS considerations, are adequate and accessible to operators.

2. Verify that operating procedures for changed processes are up-to-date and that operators are trained in their use.

b. Requirements

The verification requirements in this section of the inspection procedure should be based on the NCS evaluations identified in 02.02(b)(3).

1. Nuclear Criticality Safety Limits and Controls. During each inspection, verify by observation, discussion, and document review that NCS limits on controlled parameters and NCS control systems identified in the NCS evaluation selected are contained in written operating procedures.

Verify that operating staff can shut down the new process if NCS instructions are not clear or do not cover the operating mode and that restart authority is specified following a shutdown.

2. Nuclear Criticality Safety Participation in Establishment of Procedures. [Region Staff responsibility.]

3. Document Control of Operating Procedures. [Region Staff responsibility.]

4. Operators Trained in Operating Procedures. [Region Staff responsibility.]

5. Deviations From Procedures. [Region Staff responsibility.]

02.07 Maintenance for Nuclear Criticality Safety

a. Objectives

1. Verify that the maintenance program is structured to ensure that procedures are developed for regularly scheduled and off-normal maintenance, including NCS considerations.

b. Requirements

The verification requirements in this section of the inspection procedure should be based on the new NCS evaluations identified for review in 02.02(b)(3).

1. Scheduled Maintenance and Calibration. Every two years, verify that a program is in place to ensure maintenance schedules are established/adhered to and are adequate for active NCS control systems and that calibration schedules are established for all NCS control systems and that these schedules are consistent with license or certificate commitments.

2. Written Procedures for Maintenance and Calibration. [Region Staff responsibility.]

3. Training of Maintenance Personnel. [Region Staff responsibility.]

4. Functional Testing. [Region Staff responsibility.]

02.08 Nuclear Criticality Safety Training

a. Objectives

1. Verify that the NCS training program ensures that managers, supervisors, and staff are trained in the nature of and responsibility for NCS.

2. Verify that the training program ensures that all staff with access to fissionable material areas has appropriate initial and periodic training.

3. Verify that the NCS training curriculum is adequate.

b. Requirements

1. New Staff. Every two years, verify by discussion, document review, and direct observation that the training program requires that all staff having access to SNM areas receive training on the fission process, the NCS program, the emergency program, and each individual's authority and responsibility for NCS. Verify that each SNM handler is required to receive on-the-job training and is tested to confirm that the SNM handler has the required skill to conform to the written procedures for his or her operation. Verify that the NCSF helps supervision, upon request, in training personnel.

2. Retraining by Position - Managers, Supervisors, Operators. Every two years, verify by discussion, document review, and observation that the training program ensures that each individual receives performance-based NCS training (knowledge and skills) to understand his or her personal and organizational authority and responsibility for nuclear criticality safety. Shutdown authority when NCS is in doubt and restart authority should be covered.

3. Training Curricula. Every two years, verify by observation, discussion, and document review that the curricula contain discussions of the fission process, kinetic energy released during a fission burst, radiation released during the burst and following the burst, health effects from the criticality, and a review of NCS excursion events. Verify that the curricula contain descriptions of the neutron behavior in fissioning systems and the plant control parameters used to prevent plant criticality. Verify that causes, means of termination and lessons learned are discussed. Verify that the required response to the criticality alarm signal and to plant policy and procedures is discussed. Every year, verify that the curricula contain discussions of NCS control parameters.

4. Testing and Records. [Region Staff responsibility.]

02.09 Nuclear Criticality Safety Inspections, Audits, and Investigations

a. Objectives

1. Verify that the NCS program requires that the NCS staff inspect process operations and audit performance for NCS.

2. Verify that the NCS program requires that the procedural violations, equipment, or system failures related to NCS are reported, reviewed, and that resolutions are tracked.

b. Requirements

1. Inspection Program. Every two years, verify by observation, discussion, and document review that the regulatee has an inspection program that requires every individual to report all detected violations of written NCS requirements. The reporting, as a minimum, must be given verbally to area supervision and in writing to the NCSF. Verify that area management representatives and NCS staff are required to routinely inspect all areas. Verify that corrective actions are controlled by written instructions approved by the NCSF. Verify that the regulatee has an internal reporting program for all such events and that such reports are screened promptly to decide appropriate action. Verify that the NSCF staff are required to inspect each new installation to ensure that controls required by the NCS evaluation are in place prior to startup.

2. Audit Program. Every two years, verify by observation, discussion, and document review that audit teams assess the adequacy of the NCS program at least annually or as required by the license or certificate. Verify that the audit team report is forwarded to plant management and to appropriate plant staff. Verify that corrective actions for violations of written requirements are assigned to individuals and are scheduled. Verify that plant management accepts or rejects each audit recommendation and that corrective actions are scheduled and completed or scheduled for completion.

3. Investigation Program. Every two years, verify by observation, discussion, and document review that the regulatee has a written investigation program and has a trained cadre of investigators. Verify that the regulatee has an internal reporting program for events and that such reports are screened promptly to decide whether an investigation is appropriate. For those events requiring an investigation, ensure that the investigation is initiated promptly and completed in a timely manner.

4. Corrective Actions. Every two years, verify by observation, discussion, and document review that the regulatee has a program to confirm the adequacy of corrective actions and that the regulatee has implemented the program. Verify that the regulatee has a program to analyze and trend reportable events and to develop lessons-learned from the analyses.

02.10 Criticality Alarm Monitoring Systems

a. Objectives

1. Verify the adequacy of the monitoring/alarm system design and performance requirements.

b. Requirements

1. System Design. Every two years, verify by observation, discussion, and document review that system design features include dual detector coverage of all areas, that electronic logic requires that two detectors be in the alarm mode before sounding the alarm, that audio alarms and, as necessary due to noise levels, visual alarms are available, that system surveillance is provided to warn of detector failure, and that secondary emergency power is provided.

2. System Sensitivity. Every two years, verify by observation, discussion, and document review that alarm set points are set to alarm when radiation levels exceed the regulatory limits. Verify that access to the alarm set points is controlled to prevent inadvertent modification of the set points.

3. System Testing. [Region Staff responsibility.]

02.11 Nuclear Criticality Safety Emergency Response

a. Objectives

1. Verify that the emergency response program is adequate for response to criticality events.

b. Requirements

1. Emergency Plan. Every two years, verify that the emergency plan for nuclear criticality has been prepared and approved by management; that the plan requires that procedures clearly designate evacuation routes and that such routes are clearly identified and adequate lighting will be available during an emergency; and that the plan requires that on- and off-site organizations are informed of conditions that might be encountered.

Verify that the plan requires that NCS precautions for firefighting be included in the emergency procedures; that the on- and off-site emergency response personnel, including fire response personnel, be provided with guidance and adequate training for fighting fires in fuel handling areas. Verify that the plan includes criticality safety considerations and is approved by the cognizant safety organizations. Verify the plan requires that, for areas in which firefighting restrictions exist because of criticality safety concerns, appropriate postings be in place to clearly and concisely portray such restrictions. Verify that a Prefire Plan is available for any facility or process in which the threat of fire exists and nuclear criticality is a concern.

2. Emergency Procedures. Every two years, verify that procedures are adequate to implement the emergency plan.

3. Controlled Evacuation of Personnel. [Region Staff responsibility.]

4. Accounting of Personnel. [Region Staff responsibility.]

5. Controlled Reentry. [Region Staff responsibility.]

6. Testing of Monitor Alarm System. [Region Staff responsibility.]

7. Drills. [Region Staff responsibility.]

88015-03 INSPECTION GUIDANCE

03.00 Background

a. Possession, use, and handling of special nuclear material (SNM) at fuel cycle facilities are regulated under 10 CFR Part 70 and 76. Specific discussions of regulatee requirements related to inspection are provided in 10 CFR 70.55 and 76.121, including a requirement for NRC staff to have immediate, unfettered access to the facility always and access to records upon reasonable notice. Specific references to criticality safety issues are provided in 10 CFR 70.22, 70.24, 76.35, and 76.89. The provisions of 10 CFR 70.22 and 76.35 require that the license application contain information on the chemical and physical form of SNM; staff technical qualifications, including training and experience; description of equipment and facilities; description of procedures to protect health; and safety assessment of the facility design bases. The provisions of 10 CFR 70.24 and 76.89 require installation and use of a criticality accident monitoring alarm system. Regulatory requirements are supplemented by recommendations of Regulatory Guides 3.1, 3.4, 3.43, 3.45, 3.47, 3.52, 3.57, and 3.58. The regulatory guidance identifies the safety criteria and procedures of ANSI standards as generally acceptable but not substitutes for detailed criticality safety evaluation. Relevant ANSI standards cover administrative practices; operations with fissionable material outside reactors; storage of fissile materials; handling, storage, and transportation of LWR fuel outside reactors, criticality alarm systems, borosilicate-glass neutron absorption, and special actinide elements. The requirements of these ANSI standards are incorporated into the inspection procedures along with the above mentioned regulatory requirements.

b. The inspection procedures are organized according to the minimum set of elements required for a regulatee NCS program. Required program elements address the following functions: (1) management and administration, (2) NCS evaluations, (3) change control, (4) operating procedures, (5) maintenance

procedures, (6) NCS training, (7) NCS inspections, audits, and investigations, (8) criticality alarms, and (9) emergency response.

c. Efficient use of NRC staff and regulatee resources is based in part on division of responsibilities between NRC headquarters and region staff. Evaluation of the programmatic aspects of the regulatee's NCS program is identified as the responsibility of the headquarters staff while confirmation of implementation of the required program elements is identified as the region staff's responsibility. In particular, review of the adequacy of regulatees new NCS evaluations and of appropriateness of NCS limits on controlled parameters and NCS control systems is the responsibility of headquarters staff. Implementation of limits and controls of ongoing operations to ensure safe operation is confirmed by the region staffs. Headquarters staff reviews are anticipated on a biannual basis while region inspections are expected to be on a quarterly interval. Adoption of a performance-based success criterion may result in decrease in frequency of inspections. NCS reviews conducted in the license or certificate renewal process establish a safety baseline and subsequent headquarters inspections are focused on changes occurring since the last headquarters inspection. The detailed guidance presented below addresses each of the program elements introduced above.

d. Verify, as used in the Headquarters inspection procedure, is the process used by the Headquarters inspector to examine the technical and administrative components of the regulatee's NCS program to determine whether the NCS program is adequate to control the risk of criticality and to implement the requirements of the license or certificate. The verification process has three elements:

   1. Technical examination of the new or revised NCS evaluations, including the basic assumptions and the proper application of the calculational methods, to determine that the NCS limits for controlled parameters and NCS control systems are an adequate technical basis.

   2. Examination of the adequacy of the management practices to implement the NCS limits for controlled parameters and control systems for the new or changed processes, which constitute the administrative component of the NCS program.

   3. Assessment of attitude of the operations staff that should have a sense of ownership for the NCS program and should demonstrate vigilance for the rigor of the NCS program.

   Verification occurs when all three components are examined and found adequate to assure NCS.

e. Confirm, as used in this procedure, is the process used by the regional inspector to examine the administrative components of the regulatee's NCS program to determine whether the NCS program is being effectively implemented to control the risk of criticality and to implement the requirements of the license or certificate (that are not subject to recent change and not inspected by Headquarters). The confirmation process also has three elements:

   1. Examination of the established NCS evaluations to identify the NCS limits for controlled parameters and NCS control systems.

   2. Examination of the adequacy of the management practices to implement the NCS limits and control systems that constitute the administrative component of the NCS program.

   3. Assessment of attitude of the operations staff that should have a sense of ownership for the NCS program and should demonstrate vigilance for the rigor of the NCS program.

   Confirmation occurs when all three components are examined and found adequate to assure NCS.

f. The following definitions apply to terms used in this procedure.

   1. safe geometry system - a system whose dimensions and shape are such that a nuclear criticality event can not occur for any combination of values of system parameters including not limited to moderation; reflection; or nuclide mass, concentration, or enrichment.

   2. favorable geometry system - a system whose dimensions and shape are such that a nuclear criticality event can not occur for any combination of values of system parameters if the values of a subset of the parameters are maintained within specified limits.

   3. contingency - a change or failure of process equipment, measurement, or control systems; inadvertent human action; change in ambient conditions; or natural events which are considered unlikely.

   4. accident pathway - a unique set of events, sequential or parallel in nature, which could lead to a nuclear criticality event.

g. Several subsections of the inspection requirements have headings without any requirements. This is to let the inspector know that a necessary portion of the regulatee's NCS program is to be inspected by the regional staff.

03.01 Management and Administrative Practices for Nuclear Criticality Safety

a. Plant Policy

Plant policy is expected to contain a discussion of the importance of plant safety, including nuclear criticality safety, in relation to production activities, e.g., plant safety is as important as plant operation. Each individual, regardless of position, would be ultimately responsible for NCS in his or her own work area. The policy should empower each employee to stop operations and to question the supervisor about safety requirements and should prohibit production whenever safety questions exist.

It is expected that the manager would cause the policy to be established and provide programs for carrying out criticality safety requirements. The policy should establish that all reasonable efforts will be taken to reduce or eliminate the potential for, and the consequences of, a criticality accident. The status and adequacy of the NCS programs should be reviewed at least every two years. This policy would be communicated to the plant staff through general NCS training and through written company procedures.

b. Plant Manager's Responsibility for Nuclear Criticality Safety

The Plant Manager is expected to accept overall responsibility for NCS of operations and to show continued interest in it. He or she is expected to delegate the authority and assign responsibility for day-to-day criticality safety of operations to line management. The Plant Manager accepts responsibility by establishing an organization where everyone, both individually and organizationally, is held accountable for his or her responsibilities for the NCS program. Accountability is maintained by informing the individuals of their responsibility, by providing NCS training so that individuals and organizations can understand and accept their responsibility, and by vigilantly ensuring on a continuing basis that the delegated authority and responsibilities are being exercised properly.

The Plant Manager is also expected to provide personnel familiar with the physics of nuclear criticality and with associated safety practices to furnish technical guidance appropriate to the scope of the operations. This criticality safety function is expected to be, to the extent practicable, administratively independent of operations. The appropriate number of such personnel can only be determined by plant management. During inspections, the inspector can determine the adequacy of staff by assessing the timeliness of the completion schedule for the responsibilities assigned to the NCSF. The performance of safety evaluations can be scheduled, but the schedule must be flexible to allow for analysis of unexpected results that develop during the evaluation. The safety evaluation process must be shielded from production pressures, although production priorities should be taken into account in establishing schedules.

The responsibility for establishing practices implementing the NCS requirements should be assigned through plant instructions. Organizations responsible for formulating and carrying out the NCS program should be shown in these instructions.

Management is also expected to establish a means of monitoring the NCS program. This would generally call for delegation of operational reviews to the operations management and periodic independent review of the criticality safety organization. The NCS safety committee and/or external committees should do periodic reviews of the NCSF and the NCS program for the plant manager.

c. Operations Managers' Responsibilities for Nuclear Criticality Safety

Operations managers are expected to accept and carry out criticality safety authority and responsibilities as delegated by the Plant Manager, and accept responsibility for criticality safety for facilities under their control. These managers are expected to ensure that the plant policy and applicable criticality safety standards are effectively implemented. These managers are expected to show continuing interest in NCS by participating in the NCS program functions such as training, audits, and identification of process contingencies. These managers are expected to ensure that appropriate training is developed and provided to staff under their control so that the staff has the skills to follow the procedures. They are also expected to delegate responsibility to line managers within their organization as necessary, yet retain overall accountability for the responsibility. These managers would also be expected to establish a means of monitoring the NCS activities under their control.

Operations managers are expected to demonstrate ownership of the NCS program by being conversant in their responsibilities for NCS and being able to identify actions taken to carry out this responsibility. Actions should include assuring availability of NCS limits and controls in written procedures, controlling facility and process changes via the configuration control method, supporting the training of staff, and directly observing on-the-floor conditions.

Management control programs addressing the establishment and implementation of design basis documentation, process safety analyses, operating procedures, training, configuration control, incident investigations, audits, maintenance and surveillance should exist. This documentation should discuss information about the programmatic framework for administrative and procedural controls and the organizational framework that allows the staff to implement the programs. Enough detail should be provided to allow assessment of the organizational and programmatic structures to justify reliance on administrative and operational controls.

d. Operations Supervisors' Responsibilities for Nuclear Criticality Safety

Each supervisor is expected to accept responsibility for the safety of operations under his or her control by being knowledgeable in those aspects of NCS about operations under his or her control; by providing training and requiring that the personnel under his or her supervision have an understanding of procedures and safety considerations such that they may be expected to do their functions without undue risk; by maintaining records of training activities and verification of personnel understanding; by developing or participating in the development of written procedures applicable to the operations under their control and to maintain them to reflect current operations; by verifying compliance with NCS specifications for new or modified equipment before its use (Verification may be based on inspection reports or other features of the quality control system; by requiring conformance with good safety practices including unambiguous identification of fissile materials and good housekeeping; by reviewing active, criticality-safety-related procedures; and by participating in frequent (at least annual) reviews of operations to ascertain that procedures are being followed and that process conditions have not been altered to affect the NCS evaluation.

Operations supervisors are expected to be conversant in their responsibilities for NCS and should be able to identify actions taken to carry out this responsibility. Actions should include assurance of availability of NCS limits in written procedures, control of facility and process changes to the configuration control method, support for training of staff, and direct observations of on-the-floor conditions.

e. Nuclear Criticality Safety Function

The NCSF is expected to provide technical guidance independent of operations for the design of equipment and processes and for the development of operating procedures; to maintain familiarity with current developments in NCS standards, guides, and codes. Knowledge of current nuclear criticality information should be maintained; to consult with knowledgeable individuals to obtain technical assistance as needed; to maintain familiarity with all operations within the organization requiring NCS controls; to help with supervision, on request, in training personnel; to conduct or participate in audits of criticality safety practices and compliance with procedures as directed by management; and to examine reports of procedural violations and other deficiencies for possible improvement of safety practices and procedural requirements and to report their findings to management.

Procedures and guidelines should be established for routine activities of the Nuclear Criticality Safety Function, including participation in inspections, audits, and NCS training programs, and for the performance of NCS

evaluations. New or revised operating procedures should be reviewed by NCS staff. The routine activities of the NCSF should be done following written procedures approved by the NCSF manager.

f. Support Function Management Responsibilities for Nuclear Criticality Safety

Support function managers (e.g., configuration control, maintenance, project engineering, accountability, physical security, emergency preparedness, radiation protection, etc.) are expected to carry out their responsibilities for NCS within their areas of responsibility. The authorities and responsibilities should be conveyed to all individuals in each support manager's organization. Training must be provided so that these individuals and their organizations can accept and fulfill their responsibilities.

g. Management Involvement in Providing Written Administrative and Operating Procedures

Requirements should be established for developing, approving, and updating procedures. The approval process should be established by the Plant Manager. Management should be involved with the development of operating procedures. Biennial review of operating procedures should include operations management and nuclear criticality safety. New or revised procedures should at least be reviewed by the NCSF and be approved by the operations manager.

The management control program related to criticality safety should be a documented system that describes administrative and technical procedures. Specific authorities, responsibilities, and duties should be defined in the written administrative procedures. Such procedures should prescribe methods for formulating, implementing, and changing NCS programs.

h. Nuclear Criticality Safety Training

Management should establish NCS training requirements. Management should provide the NCS training, and require that personnel have an understanding of the procedures and safety considerations such that they may be expected to perform their functions without undue risk to themselves or their co-workers. The training should be performance based so that each individual has the skill and is expected to follow operating procedures that identify NCS limits and use of NCS control systems. Records of training activities and verification of personnel understanding should be maintained.

i. Nuclear Criticality Safety Advisory Committee

The Plant Manager should charter an advisory committee for assessing the NCS policy and program and making recommendations for program improvement. As part of its charter, the committee should periodically assess each

component of the program, i.e., the manageability, implementation, and effectiveness of NCS programs; audits, inspections, and corrective actions; design basis documentation; maintenance and surveillance; training; configuration control; and safety evaluations. The assessment should include an intensive and systematic examination and should be distinct from routine audits and should be conducted by a team with multi-disciplined personnel possessing the expertise necessary for proper review of the programs. At least annually, the committee should report to the Plant Manager on the efficacy of the NCS program.

03.02 Nuclear Criticality Safety Function

The NCSF is expected to perform its function in accord with written procedures. Guidance for these aspects of the program is provided in paragraphs (a), (b), and (c) below. Guidance for inspection of NCS evaluations is presented in paragraphs (d), (e), (f), and (g). Guidance for inspection of implementation of NCS limits and control systems is provided Section 03.04.

a. Administrative Procedures

The authority and responsibilities of the NCSF should be defined in administrative instructions. The NCS technical function is expected to develop and implement procedures governing activities under its control. Responsibilities include providing advice in process design; contributing to development and review of operating and maintenance procedures; evaluating proposed process changes; and establishing NCS limits and control systems in NCS evaluations. Administrative procedures for performing NCS evaluations should: 1) require formal and comprehensive safety evaluations, 2) provide guidance to control safety evaluation format and content, 3) require safety evaluations for all process changes and new processes, 4) require evaluation of reports of non routine events and reporting to plant management, and 5) require periodic revalidating and updating, as necessary, safety analyses and related documentation to ensure consistency with the current processes.

Procedures should be established to ensure management approval of designs in which safe geometry is not used for criticality control. Use of criticality controls, other than safe geometry, should require documented justification and management approval when NCS is based solely on use of administrative controls.

b. Qualification of Staff

Staff managing, performing, or reviewing criticality safety evaluations are expected to have appropriate educational background. Completion of a bachelors degree in physics, engineering, or physical sciences is considered minimum educational background. The NCSF manager is expected to have

at least one years experience in the administration of criticality safety programs in addition to at least two years of performing safety evaluations. Individuals performing safety evaluations should have one year of training in performing safety evaluations and in the implementation of the NCS program. Individuals performing independent reviews of evaluations are expected to have at least two years experience doing NCS evaluations and at least one year of experience at the company's facility. NCS staff should maintain familiarity with developments in NCS through attendance at NCS technical meetings, continuing education programs, and personal contacts with other NCS specialists.

c. Validation of Methods

Use of experimental data is the preferred method for establishment of NCS limits for a given process system. Validated calculational methods may be used without directly applicable experimental data. Validation means comparison of critical mass experimental results with mathematical predictions for the experimental systems to establish the bias and range of applicability. The bias and the uncertainty in the bias should be investigated and quantified. The area of applicability of the calculational method may be extended beyond or between the range of experiments by trending the bias between experimental and calculational results. The area of applicability of the validated method should be clearly defined. A report describing the experimental conditions, the calculational method, model data (cross sections, extrapolation lengths, etc.), calculational results, the bias, bias uncertainty, and range of applicability should be prepared and maintained. Installation and updating of computer codes should be controlled under a procedure that confirms mathematical operations and code predictions.

d. Nuclear Criticality Safety Evaluations

Process evaluations are expected to be provided in documentation that contains a description of the process physical, chemical, and equipment conditions; consideration of normal and off-normal conditions (process contingencies); analysis of criticality states for normal and abnormal conditions; and establishment of NCS limits and control systems. In this context, storage and transport of SNM material is considered to be a type of process operation.

The description of process chemical, physical, and nuclear characteristics provides a basis for postulation of nuclear material states within the unit operation. Descriptions of material characteristics, equipment configurations, process operations, and potential internal and external events are used to identify all possible normal and abnormal states of the process. Types of internal events that should be considered include, but are not limited to, fire, improper operation of equipment, and equipment failure. Types of

external events that should be considered include earthquake, tornado, and flood.

Events or contingencies occurring in an accident pathway may be identified from operational experience or using hazard evaluation techniques. Common mode failures must be considered in developing accident scenarios. Acceptable hazard evaluation techniques include the What If, Checklist, Hazard and Operability (HAZOP), Failure Modes and Effects (FMEA), and Fault/Event Tree analyses. Besides the NCSF staff, operations supervisors and operators are expected to contribute to the identification of contingencies. Contingencies for process conditions leading to potential criticality conditions are expected to be documented in the NCS evaluation.

The accident pathways identified in the NCS evaluation are reviewed by NCSF to establish that two or more unlikely, concurrent, and independent changes in process conditions are required before criticality could occur. Two NCS control systems must be established as barriers for each potential accident pathway. Control systems may be used as barriers for multiple pathways if two independent controls are shown to be operative for each identified pathway.

Passive, active engineered, or administrative controls are used to ensure conformance to the double contingency principle and should be identified in a formal process. Passive engineered controls are preferred to active engineered controls and active engineered controls are preferred to administrative controls. Use of only administrative controls should be justified in writing. Preference should be given to diversity of controls to provide some measure of defense against single mode failure.

e. Independent Review of Nuclear Criticality Safety Evaluations

An independent review of each criticality evaluation is required for NCSF approval of the proposed process change. This requirement is consistent with the double contingency principle in the sense that no single analytical error should allow unsafe conditions to occur. A clear, unambiguous description of the assumptions, analytical method, and results in an NCS evaluation is a required basis for the review. The independent review must be performed and documented by a qualified NCS evaluator.

f. Safety Criteria

Before start-up of any process, an NCS evaluation is required to provide assurance that each unit and the entire process is adequately subcritical under both normal and abnormal operating conditions. Critical limits may be derived from experimental data or from validated analytical methods. The evaluation should show that margins of safety that satisfy plant safety requirements are applied to just critical or slightly subcritical limits. The margins of safety can be

identified in plant safety criteria and in the NRC license or certificate. Normally the failure limit (FL) is calculated to define the just critical system, i.e., keff = 1.0. The safety limit (SL) is determined (e.g., keff = 0.97) to define the facility shutdown and investigation limit. The limiting condition for operation (LCO) should be calculated (e.g., keff = 0.95) to define the operating level for notifying plant management of nonroutine operation. The routine operating limit should be set by operations to protect the LCO. Not all regulatees use the four limits; however, the margins of safety for any process should be large enough that engineered control systems and/or operators can detect that a safety margin has been lost, thereby allowing corrective action to be taken before the process goes critical.

03.03 Plant Activities

a. Plant Tour

The plant should be toured to gain an overall impression of NCS in the plant and to become familiar with all operations.

b. Observe Operations/Implementation of New Safety Evaluations

During the review of NCS evaluations completed since the last Headquarters inspection, identify required management functions, equipment conditions, NCS limits for controlled parameters and NCS control systems, and operator and support staff activities that contribute to safe operation. Field verification of the new requirements in these safety evaluations should be the focus of this inspection effort. Operating procedures should contain NCS limits on controlled parameters and operating instructions for NCS control systems. Examination of process equipment should verify the conditions assumed in the safety evaluation and the presence of controls identified in the evaluation. Observations and discussions with operators should verify that operators know and understand process conditions, NCS limits on controlled parameters and operation of NCS control systems, and follow procedures. Review and observation of maintenance, calibration, and surveillance activities should verify that these activities are done on schedule and meet functional requirements.

03.04 Configuration Control Program for Nuclear Criticality Safety

Review of the NCS configuration control system focuses on formalization of the system, capabilities of the system, contents of documents in the system, and control of interaction between NCS and other plant functions. The configuration control program is expected to maintain design basis documentation and technical support information, including operating, maintenance, calibration, and testing procedures current and accurate so that the operations staff knows the status of equipment under their control and the NCS staff can use the documentation when doing safety evaluations or system reviews.

a. Program

The configuration control program should be well developed and documented. The records generated and maintained should include Integrated Safety Analysis (ISA) components, such as siting features that affect safety (flooding, seismology, etc.); facility and process descriptions; hazard analyses for each unit process; safety analyses that establish limits and controls; maintenance, calibration, and surveillance procedures; operating procedures; training requirements; and inspection and audit procedures.

b. Nuclear Criticality Safety Evaluations

Unit operations are individual stages in a process area. All NCS evaluations should be maintained in the configuration control system and should identify the process, process equipment, all pathways to accidents, NCS limits on controlled parameters, the two or more NCS control systems interrupting each pathway and requirements for training, postings, etc. established by the safety evaluation. The safety evaluation should clearly document all assumptions, analytic methods, and individuals doing the evaluation. The independent reviewer, the review process, and the review results should be identified and documented.

c. Maintenance, Calibration, and Surveillance of Safety Systems

Based on the safety evaluation and change process, safety related maintenance, calibration, and surveillance requirements will be identified. These requirements should be done by qualified staff through written procedures maintained within the configuration control program. The requirements are expected to include coordination with operations, lockout procedure, and return-to-service steps.

d. Procedures

Operating procedure should be based on information maintained in the configuration control system and should be maintained in the system. During development the procedures should be commented on by those affected by the procedures and those responsible for procedure development. The procedures should contain step-by-step actions and identify NCS limits and controls, necessary conditions for start-up, operation and emergency shutdown, and special warnings about hazardous situations.

e. Configuration Control Change Procedures

The change procedure is intended to guide the regulatee's staff in initiation of the change process; development, revision, and maintenance of documents; and the identification of new management functions (retaining, maintenance, audits, etc.).

f. Configuration Control Training

Plant staff should be trained to use the configuration control system to enhance safety, implement change, and be responsible for conformance to the configuration control system. This ranges from complying with operating procedures to the more complex change control process.

03.05 Nuclear Criticality Safety Change Control

a. Documentation

Change in existing processes or installation of new processes should be governed by written procedures. The procedures should require documentation of safety review of the proposed change; identification of and verification of completion of support activities, such as development or revision of operating, maintenance, calibrations, and testing procedures; and verification of preoperational testing before start-up. The progress of a proposed change, including all required activities, should be documented. This inspection activity is intended to review the change control process.

b. Verification

This inspection module verifies for changes since the last inspection that the change control procedure has been followed and documented. The tracking record of documents prepared in the change process should be complete and available within the configuration control system before operation of the changed process.

03.06 Operating Procedures

Operations to which NCS is pertinent are expected to be governed by written procedures. All persons participating in these operations should understand and be familiar with the procedures. The procedures should specify all parameters they are intended to control. They should be such that no single, inadvertent departure from a procedure can cause a criticality accident.

Operating procedures are also expected to ease the safe and efficient conduct of the operation. The procedures should be organized and presented for convenient use by operators and should be free of extraneous material.

Requirements should be established for the contents of operating procedures. The contents should include process operating limits, sequence of steps to be taken under upset conditions, safety systems and functions, precautions, and warnings. The procedures should address all aspects of operation including startup, temporary operation, and shutdown. Instructions and criteria for a shutdown and actions to be taken during abnormal operations should be specified, including the limits selected for a commitment to action.

A specific procedure should be established that ensures management approval of designs in which safe geometry is not used as the method for criticality control. Use of nuclear criticality

controls, other than safe geometry, should require documented justification and management approval.

Special controls should be specified for solution transfers from favorable to nonfavorable geometry vessels, preventing the accumulation of fissile material in process equipment, verifying the isotopic content of incoming cylinders, and backflow prevention.

Requirements should be established for measurement control. Measurement techniques employed should be identified and the technical basis for their validity provided.

Requirements should be established for moderation control within an Emergency Plan or a Prefire Plan.

a. Nuclear Criticality Safety Limits and Controls

Approved written operating procedures, posting, and labels are expected to effectively implement the limits and controls specified in the NCS analyses. The written procedures should clearly specify and uniquely highlight the parameters, limits, and actions necessary to provide criticality safety as specified in the NCS analyses. Sometimes, criticality safety specific procedures containing this information may be developed for a given operation.

b. Nuclear Criticality Safety Participation in Establishment of Procedures. [Region Staff responsibility.]

c. Document Control of Operating Procedures. [Region Staff responsibility.]

d. Operators Trained in Operating Procedures. [Region Staff responsibility.]

e. Deviations From Procedures. [Region Staff responsibility.]

03.07 Maintenance for Nuclear Criticality Safety

a. Scheduled Maintenance and Calibration

The plant is expected to have a maintenance and calibration program for all of the NCS control systems identified in the criticality safety evaluations. These systems could be instrumentation, such as temperature and level monitors, or physical systems such as barriers, constraints, neutron absorbers, etc. For these systems, NCS depends on continued maintenance of the systems and calibration of the instrumentation. Documentation, preferably the safety analyses, should identify the expected maintenance and calibration requirements for these systems.

Since NCS depends on these safety systems, it is very important that any change to the systems be carefully considered to avoid unanticipated consequences. Allowable replacement parts should be documented in procedures,

preferably the maintenance procedure for the safety system. All changes to the safety system must be approved by the NCSF before installation. A configuration control system should be in place to control these replacement parts.

b. Written Procedures for Maintenance and Calibration. [Region Staff responsibility.]

c. Training of Maintenance Personnel. [Region Staff responsibility.]

d. Functional Testing. [Region Staff responsibility]

03.08 Nuclear Criticality Safety Training

a. New Staff

A training program should be in place that ensures that all staff having unescorted access to SNM areas receive training on the NCS program, including each individual's authority and responsibility for NCS, and the emergency program. In addition, the training program should ensure that each SNM handler receives on-the-job training and is tested to the supervisor's satisfaction to confirm that the SNM handler has the required skill to conform to the written procedures for his or her operation. Written records of this training should be readily available to and used by operations, maintenance, and support function supervisors making work assignments in SNM areas.

The NCS staff would be expected to help in the development and approval of the NCS training programs, and to assist in the training if requested.

b. Retraining by Position - Managers, Supervisors, Operators

The NCS training programs should also ensure that each individual within the organization, including managers, technical, supervisors, and operators, receives performance-based training (knowledge and skills) to understand his or her organizational authority and responsibility for nuclear criticality safety. Each individual at the plant is expected to understand his or her role and responsibility for nuclear criticality safety.

c. Training Curricula

The NCS training programs are expected to be performance based, with training proportional to the position of responsibility. The criticality safety training curricula for all staff having access to SNM areas are expected to contain most core elements, including:

! A discussion of the fission process, kinetic energy released during a fission burst, radiation released during the burst and following the burst, and health effects from the criticality.

- **!** A description of the neutron behavior in fissioning systems and of the plant control parameters used to prevent plant criticality.

- **!** A discussion of the causes of accidents or significant events, means of accident termination, and lessons learned from past incidents and accidents.

- **!** A discussion of the required response to the criticality alarm signal and to plant policy and emergency response procedures.

d. Testing and Records. [Region Staff responsibility.]

03.09 Nuclear Criticality Safety Inspections, Audits, and Investigations

a. Inspection Program

The regulatee is expected to have a self-inspection program that ensures that suspected or known violations of criticality safety requirements are promptly identified and acted upon with NCS guidance in a reasoned and controlled manner. The program should require that every individual having unescorted access to SNM areas report all suspected or known violations of NCS requirements and procedures to the area supervision and in writing to the NCSF. This reporting should be "penalty free" and should be strongly encouraged so that management can take corrective action. The self-inspection program is expected to be formalized as a part of the criticality safety program and documented by procedure.

The self-inspection program is also expected to require that area management representatives and NCS staff routinely inspect and audit all areas with SNM. All operations should be reviewed frequently (at least annually) to ascertain that procedures are being followed and that process conditions have not been altered to affect the NCS evaluation. These reviews should be conducted, in consultation with operating personnel, by individuals who are knowledgeable in NCS and who, to the extent practicable, are not immediately responsible for the operation. These audits should include overall criticality safety practices and compliance with procedures. Results of these reviews are expected to be documented and transmitted to management.

The self-inspection program is also expected to require that corrective actions be done in a reasoned, controlled manner by written instructions reviewed by the NCSF.

b. Audit Program

The regulatee is expected to have an audit program to assess the adequacy of the NCS program at least annually. This audit program should be a management responsibility. A formal report of the audit team should be forwarded to plant

management and to appropriate plant staff. Corrective actions for violations of written requirements should be assigned to individuals and should be scheduled. The plant management is expected to accept or reject each audit recommendation, assign responsibility for corrective action, and schedule and monitor the progress of the corrective action in a timely manner.

c. Investigation Program

The criticality safety program of the regulatee is expected to have a written criticality safety incident investigation program and a trained cadre of incident investigators knowledgeable in criticality safety and operations. The program is expected to be structured such that events are promptly reported internally to management and the nuclear criticality staff and events are screened promptly to decide whether an investigation and/or NRC notification is appropriate. The procedures are expected to identify the process that operations, management, and nuclear criticality staffs are expected to follow when an event is identified.

A procedure should govern the classification and reporting of violations of criticality safety limits, criticality safety steps in procedures, criticality safety procedures, technical standards, and equipment failures that decrease the criticality safety margin.

A report by the investigation team should be forwarded to plant management and to appropriate plant staff. Recommended corrective actions, root causes, and lessons learned from the incident should be identified. Plant management is expected to accept or reject each recommendation, assign responsibility for corrective action, and schedule and monitor the progress of the corrective action in a timely manner.

d. Corrective Actions

Following recovery from a criticality limit violation, corrective actions should be developed and carried out to reduce the probability of reoccurrence of the problem.

03.10 Criticality Alarm Monitoring Systems

a. System Design

The regulatee is expected to have a criticality accident alarm system that, at a minimum, conforms to the requirements of ANSI/ANS-8.3-1986. The initial conformance of the regulatee's system is expected to be addressed during the licensing process. Additional review of the design and implementation of the design in the plant is expected when changes, either to the alarm system or to the plant, occur that might affect the criticality alarm systems performance. Other key design features include: provisions for dual detector coverage of all areas; electronic logic requiring

two detectors are in the alarm mode before sounding the alarm; audio alarms and, as necessary due to noise levels, other types of alarms covering all areas that could be affected by a criticality; system surveillance to warn of detector failure; and the availability of secondary emergency power.

b. System Sensitivity

Written procedures are expected to specify alarm set points to be used to show when radiation levels exceed the regulatory limits. The procedures should also provide for control of access to the alarm set points to prevent inadvertent modification of the set points.

c. System Testing. [Region Staff responsibility.]

03.11 Nuclear Criticality Safety Emergency Response

a. Emergency Procedures

The planned response by the regulatee to a nuclear criticality accident or NIM 33 alarm is expected to be outlined in emergency response procedures approved by management. Off-site organizations expected to provide assistance during emergencies should be informed of conditions that might be encountered and should be helped in preparing suitable emergency response procedures.

Nuclear criticality safety precautions for firefighting should be included in the emergency procedures. The on- and off-site emergency response personnel, including fire response personnel, should be provided with guidance and adequately trained on fighting fires in fuel handling areas. A Prefire Plan should be available for any facility or process in which the threat of fire and criticality exists due to the addition of moderator or disruption of material because of firefighting is a concern. The plan should include criticality safety considerations and should be approved by the cognizant criticality safety organization.

b. Controlled Evacuation of Personnel. [Region Staff responsibility.]

c. Accounting of Personnel. [Region Staff responsibility.]

d. Controlled Reentry. [Region Staff responsibility.]

e. Testing of Monitor Alarm System. [Region Staff responsibility.]

f. Drills. [Region Staff responsibility.]

88015-04 RESOURCE ESTIMATE

An inspection performed using this inspection procedure is estimated to require 80 hours of inspector resources. This estimate is only for the direct inspection effort and does not include preparation for and documentation of the inspection.

88015-05 REFERENCES

U.S. Code of Federal Regulations, "Domestic Licensing of Special Nuclear Material", Part 70, Title 10, "Energy."

---"Standards for Protection Against Radiation," Part 20, Title 10, "Energy."

U.S. Nuclear Regulatory Commission, "Nuclear Criticality Safety in Operations with Fissionable Materials at Fuels and Materials Facilities," Regulatory Guide 3.4, Revision 2, Washington, D.C., March 1986.

---"Nuclear Criticality Safety in the Storage of Fissile Materials," Regulatory Guide 3.43, Revision 1, April 1979.

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---"Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material," Regulatory Guide 3.1, Revision 2, September 1987.

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---ANSI/ANS-8.3-1986, "Criticality Accident Alarm System," American Nuclear Society, La Grange Park, IL, August 29, 1986.

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END