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7	1/29/24	<p>Intent change. Implements UCOR-4172/R4.</p> <p>Added responsibility for Training Manager to ensure NCS Staff Qualification records are maintained for at least four years.</p> <p>In ACR discussion, replaced “nonconformance” verbiage to the more appropriate usage of “infraction” or “deficiency”.</p> <p>Updated titles and responsibilities to match current org charts (Responsibilities changed only for N&CS and NCS Managers).</p> <p>Updated acronyms and definitions to remove ambiguity.</p> <p>Added a note referring to the PROC-OS-1107 requirement for identification markers for NCS controls in work control documents.</p> <p>Added discussion on the use of UCD discovery process in NCS exempt facilities.</p> <p>Broadened FEM discussion to include mass equivalencies for U-233 and Pu-239 FGE.</p> <p>Added discussion on handling of special reflectors in NCS analyses.</p> <p>Deleted ANSI/ANS-8.17 as an applicable standard.</p> <p>Editorial Cleanup throughout.</p>	All
6	8/10/22	<p>Intent change.</p> <p>Add responsibility and periodicity for NCSO Manager to review the NCS Program for the need of assessment by external SMEs (IF-2022-0302).</p> <p>Update all standards and orders from previous contract to latest versions under new contract.</p> <p>Clean up “Other Documents Needed” and “Source Documents” listings</p> <p>Clarify FM steps in ACR process.</p> <p>Clarify FM and RM responsibilities when requesting evaluation of new or revised FMO.</p> <p>Incorporate new list of fissionable isotopes in definitions section and resulting new FMCL and FEM values to implement ANSI/ANS 8.15-2014.</p>	5, 6, 8, 10, 12-14, 17, 18, 20, 27, 28, 35, 39, 40, 42, 45- 47, 52, 53, 60, 63, 65
5	2/2/22	<p>Intent change. Title Changes.</p> <p>Update responsibilities.</p> <p>Moved exemption limits to Attachment H for clarity.</p> <p>Added labels to references of signs and postings.</p> <p>Add clarification to the concentration exempt limit.</p> <p>Add removable contamination exemption limit.</p> <p>Anomalous condition process updated to include a discovery period.</p> <p>Update applicable ANSI/ANS standards to latest revisions.</p> <p>Added references.</p> <p>Removed unused definitions.</p> <p>Removed forms that were attachments and created them into official UCOR forms.</p> <p>Editorial changes.</p>	All
4	4/28/15	<p>Intent change.</p> <p>Updated DOE Order 420.1B to DOE Order 420.1C.</p> <p>Updated to reference Corrective Action Management System.</p> <p>Updated all ANSI/ANS standards to latest revisions.</p> <p>Changed NCS Deactivation Form to NCS De-Implementation Form.</p> <p>Changed description of crosswalks and usage.</p> <p>Deleted description of operations being controlled by a single parameter as not meeting double contingency principle.</p> <p>Changed title of Chief Technical Officer to Nuclear Services and Engineering Manager.</p> <p>Changed title of Nuclear Facility Safety Senior Manager to Nuclear Facility Safety and Criticality Manager.</p>	10, 28, 29, 30, 43, 71

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3	4/15/13	<p>Intent change.</p> <p>Update reference to UCOR-4113, <i>URS CH2M Oak Ridge LLC (UCOR) Nuclear and Radiological Facilities Qualification Standard</i>.</p> <p>Added more information concerning use of NCS exemption criteria.</p> <p>Alter NCSRC functions to match those in UCOR-4172.</p> <p>Clarify the NCS review process.</p> <p>Define clarification process.</p> <p>Updated training attachment.</p>	4, 5, 6, 7, 9, 11, 13, 19, 25, 26, 27, 28, 29, 31, 32, 36, 37, 38, 39, 41, 43, 48, 52, 68, 69, 71
2	2/18/13	<p>Intent change. Address I/CATS I0080552. Delete reference to Attachment I, which was previously deleted.</p>	9, 14, 18
1	6/14/12	<p>Changed BJC/OR-3035, Nuclear Criticality Safety Program Description, to UCOR-4172, Nuclear Criticality Safety Program Description.</p> <p>Reworded some UCOR NCSO Manager responsibilities – editorial only.</p> <p>Added to footnotes a. and b. of Table 1 to clarify values are based on single-parameter limits for isolated aqueous mixtures.</p> <p>Revised footnote to concentration exemption.</p> <p>Changed PM to APM in Step. 13 for reporting infractions and deficiencies.</p> <p>Added note with permissive to allow provisional qualification of NCS Engineer if NCSO Manager defers any requirements due to unavailability of resources.</p> <p>Added steps for Sr. NCS Engineer, Sr. NCS Engineer Analyst and Sr. NCS Engineer Shielding Analyst to concur with candidate’s knowledge during qualification.</p> <p>Added step for NCSO Manager to periodically review the NCS Engineer training and qualification program.</p> <p>Adjusted step numbers in Note 2 due to step deletion below.</p> <p>Deleted step for CTO to notify APM since APM is notified by the NCS Engineer.</p> <p>Added missing step number – editorial.</p> <p>Deleted Attachments H and K and moved information to notes where it is called out in procedure steps.</p>	4 - 7 12- 14 19 - 20, 26, 27 31, 34, 38, 39 41, 42
0	2/16/12	<p>Initial release. Replaces BJC-NS-1003 (Rev. 12), <i>Nuclear Criticality Safety Program</i>.</p>	All

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PURPOSE This procedure establishes the policy, guidelines, rules, and regulations for the United Cleanup Oak Ridge LLC (UCOR), Nuclear Criticality Safety (NCS) Program (NCSP) to ensure that NCS hazards are evaluated and NCS limits and controls are established and implemented to provide personnel safety, public safety and to protect the environment.

The intent is to establish responsibilities for NCS, prevent, or identify and correct unsafe accumulations of fissile/fissionable materials within plant equipment and facilities, and to use every practicable means to ensure maximum safety through the prevention or mitigation of the consequences of nuclear criticality accidents.

SCOPE This procedure applies to all UCOR and subcontractor personnel, facilities (including transportation), and equipment involving fissile/fissionable material at U.S. Department of Energy (DOE)-owned facilities designated in the contract.

NOTE 1: Subcontractors should contact their Subcontract Coordinators (SCCs)/Subcontract Technical Representatives (STRs) for assistance in understanding or complying with this procedure.

NOTE 2: The terms “fissionable” and “fissile” are used interchangeably, but conformance with established terminology is recommended (e.g., Fissile Control Area, Fissionable Equivalent Mass, etc.).

OTHER DOCUMENTS NEEDED

- UCOR-4113, *UCOR LLC Nuclear and Radiological Facilities Qualification Standard, Oak Ridge, Tennessee*
- UCOR-4172, *Nuclear Criticality Safety Program Description, Oak Ridge, Tennessee*
- CHT-UCOR-208, *Nuclear Criticality Safety Review Committee*
- POL-UCOR-012, *Nuclear Criticality Safety*
- PROC-NS-1005, *Nuclear Criticality Safety Evaluations and Calculations*
- PROC-OS-1001, *Records Management, Including Document Control*
- Form-554, *Safety Document Worksheet*
- Form-3563, *Verification Checklist for NCSE/NCSD Implementation*
- Form-3564, *NCS Surveillance Report*
- Form-3565, *Anomalous Conditions Report*
- Form-3566, *NCS Request and Scope Form*
- Form-3567, *NCS Exemption Form*
- Form-3568, *De-implementation Form*
- Form-3569, *NCS Cancellation Form*
- Form-3570, *Anomalous Conditions Report Addendum*
- Form-3571, *NCS Clarification Form*
- NCSR-MS-0000000-0001, *Nuclear Criticality Safety Performance Metrics Guide*

EXEMPTIONS Exemptions to selected requirements of this procedure may be granted on an individual basis by the NCS Organization (NCSO) Manager. Such exemptions shall be in writing and shall document the reason for the exemption.

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**PROGRAMMATIC
RESPONSIBILITY
AND AUTHORITY**

NOTE: This section addresses UCOR programmatic responsibilities. The only subcontractor responsibilities in this section are those that apply to the Subcontractor Quality Assurance Manager.

A. President and Chief Executive Officer

1. Responsible for the NCS of operations within the DOE-owned facilities designated in the UCOR contracts with DOE.
2. Establish through this procedure the project organizations necessary to ensure that (1) supervision is made responsible for NCS of operations, surveillance, maintenance, or other functions; and (2) a NCS group, staffed with personnel skilled in the interpretation of data pertinent to nuclear criticality and familiar with operations, serves as advisors to supervision.
3. Ensure that UCOR has adequate resources to maintain an effective NCSP.

B. Technical, Engineering, and Nuclear Safety (TENS) Manager

1. Approve the NCS Program Description Document (UCOR-4172, Nuclear Criticality Safety Program Description, Oak Ridge, Tennessee).
2. Appoint members to Charter, sponsor and appoint members to the Criticality Safety Review Committee (CSRC).

C. Nuclear and Criticality Safety Manager

1. Maintain an effective NCSP.
2. Ensure an NCS policy statement is established outlining NCS Program objectives and UCOR management responsibilities.
3. Ensure that corrective actions resulting from periodic self-assessments, surveillances, audits, appraisals, or Anomalous Condition Reports (ACR) are planned, initiated, and tracked to completion. Ensure audits for ongoing projects are performed.
4. Ensure that managers are adequately trained in fissile material operations (FMOs).
5. Provide personnel familiar with the physics of nuclear criticality, associated safety practices, and facility operations to furnish technical guidance to management for FMO and to establish NCSP operational and administrative requirements.
6. Ensure that NCS personnel are independent of operations to the extent practicable.

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7. Ensure NCS personnel are an integral part of preparation and review of new or revised safety basis documentation.

D. Nuclear Criticality Safety Manager

NOTE 1: The NCS Manager has been identified as NCSO Manager at different times. Usage of either title is acceptable when referring to the manager of the NCS program. Likewise, the NCSO may be referred to as NCSO, NCS Staff, or simply NCS, meaning any employee fulfilling duties assigned to members of the NCS group (e.g., Criticality Safety Officer [CSO], NCS Engineer, NCS Manager).

NOTE 2: The NCS Manager may assign a designee at individual sites or projects (e.g., Molten Salt Reactor Experiment [MSRE]) to fulfill specific responsibilities in this section for that Site/Project. Site/Project Designees shall meet the qualification requirement of the NCS Manager.

NOTE 3: The NCS Manager may assign a designee to fulfill specific responsibilities in this section. Designees shall meet the qualification requirement of a Senior NCS Engineer unless otherwise noted.

1. Qualify as a NCS Manager as required in UCOR-4113, United Cleanup Oak Ridge LLC (UCOR) Nuclear and Radiological Facilities Qualification Standard, Oak Ridge, Tennessee.
2. Provide NCS requirements for a new FMO or a change to an existing FMO.
3. Ensure the NCS training program effectively trains personnel to conduct FMOs.
4. Ensure that FMOs with a credible risk of criticality and Criticality Accident Alarm System (CAAS) requirements are evaluated against DOE Order (O) 426.2, Personnel Selection, Training, Qualification and Certification Requirements for DOE Nuclear Facilities, to determine if DOE fissile material handler certification, or equivalent is required.
5. Ensure adequacy of personnel selection, qualification, and training programs for NCS engineers and Criticality Safety Officers (CSO) providing services to FMOs.
6. Ensure documentation is maintained demonstrating that the NCS staff meets the qualifications established by this procedure.
7. Develop and implement NCSP requirements as defined in UCOR contracts with DOE.

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8. Ensure that FMO work performed for UCOR by other companies complies with NCSP requirements by ensuring inclusion of the requirements in master service agreements or subcontracts.
9. Ensure quality control and configuration control of UCOR NCS software and data sets used for evaluations or analyses.
10. Provide the Subject Matter Expert (SME) in the development of NCS fundamentals training and operation-specific NCS Training (as requested).
11. Conduct or participate in facility assessments, as needed, to determine causes of negative NCS trends.
12. Ensure audit and deficiency reports are examined for possible improvements to the NCSP, and report any need for improvement to management upon identification.
13. Assist in emergency preparedness planning, as required. Review and comment on emergency response procedures, including determination of the Immediate Evacuation Zone (IEZ), as required.
14. Participate, as requested, in Emergency Operation Center (EOC) drills and exercises, and during actual NCS-related emergencies.
15. Participate in the development of NCS procedures, as needed.
16. Serve as the primary contact for NCS occurrences and issues and NCS-related matters. For NCS occurrences, participate in the compilation of a report and direct corrective actions.
17. Ensure lessons learned are generated, NCS occurrences and issues are tracked, trending analysis is performed to identify potentially adverse trends and prevent recurrence, and results are reported to management upon request. Support Responsible Manager, as necessary, in determination of corrective actions for recurrence prevention.
18. Interface on NCS-related matters with program/project management, the site-specific operations review committees, and external organizations (e.g., DOE).
19. Review and approve the NCS program procedures (PROC-NS-1003, Nuclear Criticality Safety Program, and PROC-NS-1005, Nuclear Criticality Safety Evaluations and Calculations).
20. Review and approve NCSEs, NCS Determinations (NCSD), NCS Clarifications (NCCF), ACRs, Nuclear Criticality Surveillance Reports (NCSV), Nuclear Criticality Verification Checklists (NCVC), NCS Reports (NCSR), and NCS Exemption (NCEX).

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21. Ensure applicable NCS requirements are included in Work Execution Documents (e.g., work packages or procedures) or subcontracts for projects involving fissile materials.
22. Ensure NCS design requirements in the design of facilities or facility modifications that affect fissile material are established through the NCS evaluation (NCSE) process.
23. Provide NCS interpretations/clarifications for existing NCSEs and NCSDs, as necessary.
24. Initiate tasks for the CSRC.
25. Ensure the CSRC charter and minutes of its meetings and any documents generated by the CSRC are maintained.
26. Review subcontractor NCSP documents, if applicable.
27. Ensure subcontractor implementation of the UCOR NCSP is assessed on a periodic (at least annually) basis, when applicable. This assessment should utilize metric data and results from other assessments, as appropriate.
28. Ensure periodic (at least quarterly) assessment of American National Standards Institute/American Nuclear Society (ANSI/ANS)-8.19 criteria, with all applicable elements assessed at least once during each three-year period.
29. Ensure periodic (at least biennial) evaluation of UCOR NCS training, including classroom, NCSE/NCSD-specific and on-the-job training.
30. Periodically (at least triennially) review the results of NCS document reviews, programmatic assessments, NCS training evaluations and negative trends indicated on the NCS performance metric data; and determine the need for review of aspects of the NCS program by external (non-UCOR and non-DOE) SME(s).
31. Ensure NCS personnel submit NCS performance metric data to the UCOR Performance Metrics Coordinator in accordance with NCSR-MS-0000000-0001, Nuclear Criticality Safety Performance Metrics Guide.
32. Ensure priority is assigned to incoming requests for NCS support, as appropriate.
33. Provide an NCS SME on the Safety Basis Review Board (SBRB), when applicable.

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E. UCOR Emergency Services Manager

NOTE 1: For several sites, the emergency preparedness and emergency response functions are provided by organizations other than UCOR. The UCOR Emergency Services Manager (or designee) is responsible for ensuring the requirements below are implemented either directly through UCOR or through integration of the UCOR NCS program with the site lead contractor.

NOTE 2: This section is applicable to UCOR facilities/activities that require a CAAS; when an NCSE documents the non-trivial potential for a nuclear criticality.

1. Verify integration of facility-level NCS program with site lead contractor emergency preparedness program.
2. Verify and validate facility-level NCS program emergency plans are developed and maintained along with procedures that address the proper response.
3. Verify and validate established evacuation routes and methods for timely facility evacuation, that facility changes do not unnecessarily impede or otherwise lengthen evacuation time, and that, to the extent possible, routes do not require personnel to approach potential sites of a nuclear criticality accident.
4. Verify and validate assembly areas for use by evacuating personnel in the event of a nuclear criticality accident are designated and are a sufficient distance from potential accident locations or provide protection to minimize potential for further radiation exposure.
5. Verify and validate appropriate personnel are trained to recognize the criticality accident alarm and know the layout of the facility, evacuation routes, location of assembly stations, and personnel accountability and monitoring methods.
6. Verify and validate the establishment of the IEZ and establish a means to account for personnel during an emergency including transient personnel.
7. Verify and validate conduct of periodic evacuation drills (at least annually) for those personnel working in facilities within a CAAS IEZ.
8. Verify and validate instrumentation and procedures for determining radiation doses at assembly stations in evacuated areas following a nuclear criticality accident are available.
9. Integrate facility-level emergency CAAS activations and associated emergencies with site-wide lead contractor emergency response organization offsite notifications.

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F. Quality Assurance (QA) Manager

1. Conduct audits of NCSP implementation, as requested by the NCS Manager or other UCOR Management, to ensure related procedures and requirements are followed, which should include incorporation of any other NCS audits.
2. Report to management the need for improvement of the NCSP based on audit results.

G. Criticality Safety Review Committee

1. Follow the CSRC charter (CHT-UCOR-208, *Nuclear Criticality Safety Review Committee*) to be engaged as directed by the CSRC chairperson, NCS Manager, or TENS Manager.
2. Provide senior management with appraisals of the effectiveness of the NCSP, as requested.
3. Perform review of the overall effectiveness of the NCSP, including subcontractor implementation of the NCSP and evaluation of the NCS training program, as requested.
4. Provide guidance to management for principles and policy of the NCSP, including the resolution of any conflicting interpretations of NCS policies and procedures, as requested.
5. Provide recommendations to senior management for special operations and for proposed changes to NCS Criteria and Policies, as requested. See Attachment F for NCS Criteria and Policies.
6. Review, as requested, new and/or revised non-FMO determinations and safety basis issues as they pertain to NCS.
7. Review NCSEs to ensure the technical basis of maintaining subcriticality, using the double contingency principle or evaluations showing criticality is not credible, is satisfactory, as requested.
8. Assess the effectiveness of implementing NCS limits and controls including procedure flow down and the incorporation of lessons learned, as requested.
9. Verify for selected UCOR-managed facilities, whether annual facility self-assessments are ensuring fissile material storage and operations remain in compliance with applicable NCS limits and controls and the NCSP procedures, as requested.
10. Review NCS ACRs and determine if the causes indicate identifiable weaknesses in the NCSP, as requested.
11. Review, as necessary, the CAAS maintenance programs to ensure they are effective and in accordance with regulatory requirements, and the status of CAAS infractions/instrumentation problems.

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12. Review, as necessary, the technical adequacy of the justification for CAAS coverage or for not requiring CAAS coverage in NCSEs.
13. Confirm EOC Procedures and the emergency plans/procedures for facilities required to have CAAS instrumentation are periodically reviewed and determined to provide effective response.
14. Participate, as requested by management, in the investigation of criticality safety violations.

IMPLEMENTATION RESPONSIBILITIES AND AUTHORITY

NOTE: This section addresses implementation responsibilities. Subcontractors are expected to comply with all responsibilities for positions within their scope of work.

A. Area Project Manager

1. Responsible for the NCS of the FMO in the Area Project Manager's (APM) scope.
2. Ensure periodic assessment and surveillances for NCS are performed.
3. Ensure corrective actions for an FMO resulting from periodic self-assessments, surveillances, audits, appraisals, or ACRs are planned, initiated, and tracked to completion.
4. Attend NCS Training for managers/supervisors as identified in Attachment B.

B. Project Manager

NOTE: If there is no assigned APM, then the Project Manager (PM) assumes the responsibilities discussed above.

1. Responsible for the NCS of the FMO in the PM's scope.
2. Responsible for ensuring subcontractors comply with applicable subcontract requirements, safety basis documents, procedures, and NCSEs/NCSDs.
3. Obtain NCS analyses for FMOs under their control.
4. Ensure program/project planning provides for the NCS analyses, documentation, reviews, and approvals prior to initiating any new or modified FMO.
5. Ensure the FM and/or Responsible Manager completes Form-3566, *NCS Request and Scope Form*, for a new FMO or revision to an existing NCSE/NCSD.
6. Responsible for the development of plans, procedures, and instructions that include NCS requirements applicable to the FMO in their scope.
7. Ensure NCS has been designed into the FMO and meet the expectations of POL-UCOR-012, *Nuclear Criticality Safety*.

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8. Ensure controls for an FMO are being properly implemented and functioning satisfactorily.
9. Arrange for periodic (at least annual) assessments of NCSEs, NCSDs, and implementing controls. This includes a review of facility operations to ascertain procedures and postings are being followed and process conditions have not been altered, which might adversely affect analyses.
10. Maintain NCS staff training in both the general and operation-specific aspects of NCS.
11. Attend NCS Training for managers/supervisors as identified in Attachment B.

C. Facility Managers

1. Responsible for verifying applicable requirements of this procedure are being implemented in their facilities prior to authorizing FMO work activities.

NOTE 1: In those activities involving source, standard, waste storage, or other activities in which very small quantities, enrichments, or concentrations of fissile material (below values stated in Attachment H) are involved, formal approval of an operation in the form of an NCSE or an NCSD is not required.

NOTE 2: For material considered NCS Exempt, the fissile material involved must meet one of the exemption criteria established in Attachment H and shall not be stored with other non-exempt levels of fissile material (i.e., governed by an NCSE or NCSD) without specific NCS approval.

2. Ensure records of fissile material inventories are maintained for each FMO in their facilities governed by NCSEs/NCSDs and ensure these records are accurate, complete, and readily available.
3. NCS Exempt (see Attachment H) labels or tags (Attachment C) may be applied to containers or items that have fissile material present in such small quantities that no operator controls are required and criticality has been determined to be not credible. Items so marked should be tracked in a database with the mass and enrichment information, as applicable, for the items. The label should be easily legible, where its form may be selected to suit site requirements, yet be consistent for a given site.
4. Work with NCS in the determination of credible process upsets and scenarios to be included in the NCS documentation and include necessary container labeling, as appropriate, to ensure proper identification and content.
5. Provide input to NCS in determination of NCS limits and controls for new or revised NCSEs. Ensure adequate material inventory information is provided to the NCS Engineer to accurately describe the FMO.
6. Ensure FMOs and NCS exemptions have had the proper level of NCS review and documentation prior to authorization to proceed with the operation.

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7. Ensure the annual NCS surveillances of applicable NCSE/NCSD are performed.
8. Ensure facility self-assessments of FMOs are performed to verify compliance with ANSI/ANS-8.19. Elements of ANSI/ANS-8.19 may be performed in portions over a period of time (i.e., every three years). Ensure all elements of ANSI/ANS-8.19 are assessed. These self-assessments are in addition to the annual NCS surveillance for NCSEs and NCSDs.
9. Ensure FMOs comply with an approved and implemented NCSE/NCSD.
10. Ensure the safety basis documents (e.g., Technical Safety Requirement [TSR]/Documented Safety Analysis [DSA]) contain the criticality safety basis for performing FMOs. If the nuclear criticality safety of the FMO relies upon a single nuclear parameter to ensure subcriticality, and a passive engineered feature is credited as a control for that process parameter, ensure the engineered feature is a DSA design feature controlled in a configuration management plan.
11. Ensure FMO plans, procedures, and instructions incorporate the limits, assumptions, operational limitations, and initial conditions from applicable NCSEs/NCSDs and are highlighted or annotated in the work control document.
12. Initiate NCSE/NCSD revision requests, NCS occurrence notifications and reporting, and the Unreviewed Safety Question Determination (USQD) process for all changes to FMOs and FMO work control documents, as necessary.
13. Ensure FMOs and access to FMO areas, is controlled.
14. Report NCS infractions and deficiencies to the NCSO and APM promptly (e.g., within one hour).
15. Ensure NCS Anomalous Conditions are investigated per the requirements of this procedure.
16. **IF** an FMO procedural deviation or unforeseen alteration in process conditions is identified, **THEN**
 contact the NCSO for assistance in developing corrective actions.
17. Execute corrective actions as approved by the NCS Manager and verify completion of corrective actions.
18. Ensure NCS training is maintained for facility personnel in both the general and operation-specific aspects of NCS.
19. Attend NCS Training for Managers/Supervisors as identified in Attachment B.
20. Authorize work in their facilities.

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D. Fissile Material Supervisor

1. Maintain NCS Training for Supervisors as identified in Attachment B.
2. Accept responsibility for the NCS of operations under their control.
3. Understand the NCS limits, controls, operational limitations, assumptions, and initial conditions for FMOs in their scope.
4. Work with the NCSO in the determination of credible process upsets and scenarios.
5. Provide any requested input to the NCSO in determination of NCS limits, controls, operational limitations, assumptions, and initial conditions for new or revised NCSEs/NCSDs.
6. Participate in required NCS training and ensure personnel participating in the FMO are trained and understand the procedures, plans, and NCS practices associated with their scope of activities.
7. Modify and maintain FMO plans, procedures, and instructions to incorporate NCS requirements, operational limitations, assumptions and initial conditions and ensure the limits and conditions are highlighted or annotated in the procedure.
8. Ensure compliance with NCS requirements, operational limitations, assumptions and initial conditions before using new or modified equipment or beginning a new or modified FMO, and monitor the FMO to verify ongoing compliance.
9. Ensure as-built conditions conform to NCS design limits and conditions.
10. Require conformance with good housekeeping and clear identification of fissile materials.
11. Report any deviations of NCS requirements or unusual “as found” conditions to the Responsible Manager of the FMO and/or the Facility Manager.
12. Participate in the task of discovering the cause of an Anomalous Condition, as needed.

E. Fissile Material Workers or Waste Handlers

1. Accept responsibility for the safety of operations under their control.
2. Maintain NCS Training as identified in Attachment B.
3. **DO NOT** perform FMOs unless NCS training is current for the activity.
4. Conduct FMOs in strict accordance with approved plans, procedures, and instructions.

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5. Work with the NCSO in determining credible process upsets and scenarios.
6. Know and follow emergency response procedures.
7. **IF** uncertain of job tasks involving fissile materials, **THEN** ask the Fissile Material Supervisor for additional training, guidance, or instruction before proceeding with work.

F. Fissile Control Area (FCA) Support Personnel

1. Maintain FCA support personnel qualification by attending NCS Training as identified in Attachment B.

NOTE: NCS for Support Personnel Training is required for all unescorted personnel whose activities do not involve movement of fissile materials (e.g., maintenance personnel, security personnel, etc.) and who enter FMO areas. NCS for Support Personnel Training, NCS Fundamentals Training, or NCS Training for Managers/Supervisors is required to escort personnel into FMO areas. Escorted personnel are not allowed to handle or move fissile material.

G. Nuclear Criticality Safety Engineer

1. Qualify as an NCS Engineer under the UCOR NCS Engineer Qualification program (What To Do, Section A) and adhere to the NCS Criteria and Policies given in Attachment F.
2. Write and peer review NCSEs, NCSDs, NCSRs, NCCFs, and NCEXs as qualified.
3. Maintain familiarity with assigned FMOs.
4. Document any justification for not having CAAS coverage at specific facilities and site locations that contain fissile materials in the appropriate NCSE/NCSD.
5. Develop NCS requirements, operational limitations, assumptions and initial conditions for FMOs.
6. Review and approve FMO designs, plans, procedures, instructions, and administrative aids that implement NCS requirements or potentially impact NCS.
7. Verify NCSE/NCSD implementation.
8. Support NCS assessments, as requested by management.
9. Maintain knowledge of NCS-related standards, guides, and codes.
10. Provide assistance in the NCS training process as the SME, participating as required in the development of the training program, its implementation, and the evaluation of its effectiveness.

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11. Review applicable facility Safety Basis documents (e.g., Preliminary Hazard Screening, Hazard Analysis Document, USQDs, and DSA) for NCS. For a DSA this includes, at a minimum, the following specific actions:
- Ensure process and/or facility descriptions within applicable NCSEs or NCSDs are consistent with descriptions in the DSA.
 - Ensure Hazard and Accident Analysis discussions concerning criticality within the DSA are consistent with the conclusions of applicable NCSEs or NCSDs.
 - Ensure any accidents identified in the DSA that could affect the NCS of the FMO are addressed in NCSEs/NCSDs, as appropriate.
 - Coordinate with the Technical Safety Requirement development personnel to ensure important criticality controls or assumptions are included in the DSA Technical Safety Requirements and documented in the applicable NCSR.
 - Ensure the criticality safety management program description within the DSA is accurate and complete.
 - Ensure for less than Hazard Category 3 safety basis documents that NCS exemptions and NCSDs are appropriately incorporated.
12. Provide input to site Emergency Planning documents for each Category 2 and 3 nuclear facility, and Radiological Facility, as requested.

NOTE: The NCS Clarification Form (NCCF), Form-3571, is to be used for clarifications that do not change the intent of requirements or bases in NCS documents (i.e., NCSE or NCSD). For clarifications to this procedure, the Field Change Process of PROC-OS-1107, *Performance Document Process*, is to be used.

13. Prepare NCS clarifications as necessary to ensure a clear understanding of NCS requirements or bases defined in NCS documents (i.e., NCSE or NCSD).

H. Criticality Safety Officer

NOTE: Only applies at sites/facilities with assigned CSOs.

1. Qualify as a CSO under the UCOR CSO Qualification program (What To Do, Section A) and adhere to the NCS Criteria and Policies of Attachment F.
2. Provide support to Facility Managers and APM for NCS Implementation Responsibilities.
3. Coordinate with NCS Engineer in support of NCS documents and implementation.
4. Review NCSEs, NCSDs, and NCSRs.
5. Review work packages and procedures involving facility changes or activities and operations which potentially affect NCS.

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6. Maintain familiarity with assigned FMOs.
7. Serve as liaison for criticality safety matters between Decontamination and Decommissioning (D&D) or Facility Operations personnel and the NCS Organization.
8. Provide daily criticality safety field support to D&D or Facility Operations staff.
9. Reinforce project management/staff ownership of NCS, including awareness that NCS takes precedence over schedule and cost.

I. Responsible Manager

1. Review and accept responsibility for assigned ACRs and ACR Actions.
2. For each ACR assigned, determine whether any corrective actions to prevent recurrence are necessary and develop resultant actions.
3. For each ACR Action assigned, complete the assigned action and submit closure evidence to NCS.
4. Initiate NCSE/NCSD requests by completing Form-3566, *NCS Request and Scope Form*, for a new FMO or revision to an existing NCSE/NCSD.

WHAT TO DO

NOTE 1: The word “shall” is used to denote a requirement, the word “should” to denote a recommendation, and the word “may” to denote permission, neither a requirement nor a recommendation.

NOTE 2: Unless otherwise specifically identified herein, the following steps apply to UCOR or subcontractors. Subcontractors are responsible for all steps applicable to their scope of work.

A. Qualifying NCSO Personnel

NOTE: At the discretion of the NCS Manager, certain requirements for NCS staff qualification may be deferred until the resources required to meet those requirements are available. For example, if the training requirement for a hands-on critical experiments class cannot be met because a suitable course is not available, provisional qualification can be granted that allows an individual to function as a qualified NCS Engineer until such time that a course is available. In such cases, provisional qualification may be given until the deferred training is completed.

NCS Manager

1. Ensure NCS Engineers and CSOs meet the qualifications of UCOR-4113, or have an approved exemption or deferral, before performing unassisted NCS Engineer or CSO functions.

NCS Engineer Candidate and CSO Candidate (as applicable)

2. Complete assignments and document qualifications on the NCS Engineer (e.g., Engineer, Analyst, Senior Shielding Analyst) or CSO (as applicable) qualification record and sign appropriate signature blocks (UCOR-4113).

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| Senior NCS Engineer | 3. | <p>Observe the NCS Engineer candidate's work (this can include previous shared work experience with the candidate), hold an informal oral examination with the NCS Engineer candidate, or determine if the NCS Engineer candidate was qualified at another similar facility through a NCS program that meets the intent of the UCOR NCS Engineer qualification program. Concur the candidate is knowledgeable of how to use industry standards, national NCS references, and the NCS engineer can satisfactorily apply the principles of nuclear criticality safety. Topics to be considered in this review include, but are not restricted to, the following:</p> <ul style="list-style-type: none"> • Industry standards and regulatory requirements; • Competency in preparing NCSEs/NCSDs; • Hazards identification and safety analysis methods; • NCS input to safety basis documents; • Implementation of NCS into work control documents; • Inventory control and characterization practices. |
| Senior NCS Engineer Analyst | 4. | <p>Observe the NCS Engineer Analyst candidate's work (this can include previous shared work experience with the candidate), hold an informal oral examination with the NCS Engineer Analyst candidate, or determine if the NCS Analyst Engineer candidate was qualified at another similar facility through a NCS program that meets the intent of the UCOR NCS Engineer Analyst qualification program. Concur the candidate can satisfactorily apply the principles of NCS analysis and is knowledgeable of how to use qualified Monte Carlo software (e.g., SCALE, MCNP) for k_{eff} calculations.</p> |
| Senior NCS Engineer Shielding Analyst | 5. | <p>Observe the NCS Engineer Shielding Analyst candidate's work (this can include previous shared work experience with the candidate), hold an informal oral examination with the NCS Engineer Shielding Analyst candidate, or determine if the NCS Engineer Shielding Analyst candidate was qualified at another similar facility through a NCS program that meets the intent of the UCOR NCS Engineer Shielding Analyst qualification program. Concur the candidate can satisfactorily apply the principles of shielding analysis and is knowledgeable of how to use qualified shielding software (e.g., SCALE, MCNP) capable of calculations that include development of response functions and application of transport methods.</p> |
| NCS Manager | 6. | <p>Confirm candidate's completion of assignments and qualification by signing appropriate signature blocks.</p> |
| Training Manager | 7. | <p>Maintain NCS Qualification Records for a minimum of 4 years, or in accordance with UCOR requirements, whichever is longer.</p> |
| NCS Manager | 8. | <p>Ensure the NCS training and qualification program is reviewed periodically for effectiveness, and results are documented.</p> |

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B. Requesting an NCSE or NCSD

Facility Manager or Responsible Manager

1. After determining through guidance provided in the Implementation Responsibilities and Authority Section, Step C.1, that an NCSE or NCSD should be developed, request assistance from the NCSO to develop new NCS documentation for an FMO or revision to existing NCS documentation, as required.

NOTE: For facilities with assigned CSOs, the CSO will support and coordinate the NCS document request.

Facility Manager or Responsible Manager

2. Request an NCSE/NCSD by completing Form-3566, *NCS Request and Scope Form*, for a new FMO or revision to an existing NCSE/ NCSD. The request shall be written and include a description of the new FMO or the change to the existing FMO.
3. Ensure Nuclear Safety (NS) support personnel are aware when a new or revised NCSE/NCSD will be written and ensure appropriate USQDs are performed for new/revised procedures/activities against applicable safety basis documents.
4. Ensure fissile material workers and supervisors participate in identification of operational upsets, hazards, potential accidents/controls, and wording for NCSE postings.
5. Provide the necessary information to NCS to analyze the FMO. This information shall include the following, as appropriate:
 - Description of the process and equipment, including as-built engineering drawings, flow diagrams, facility layout drawings, sketches, and operating procedures.
 - An accurate and complete inventory of the FMO or the facility total fissile material inventory.
 - Identification of existing engineered controls, limiting safety system settings, and limiting operating conditions that are applicable to NCS.
 - Description of normal process conditions and credible abnormal conditions.
 - Type of all materials (fissile and non-fissile) involved in the activities or process along with information pertinent to the physical and chemical forms.

6. Obtain assistance from NCS as appropriate.

NCS Engineer

7. Provide assistance to Facility or Responsible Manager in determining the appropriate NCS documentation requirements for a new or modified FMO and preparing the necessary documentation per PROC-NS-1005, *Nuclear Criticality Safety Evaluations and Calculations*.

NCS Manager or Designee

8. Review NCSE/NCSD request, determine priority, and assign NCS Engineer and peer reviewer, as necessary. A graded approach may be applied depending on the level of risk and complexity of the operation.

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NCS Engineer **9.** Meet with operations to clearly identify the scope of the NCSE/NCSD. The scope of the NCSE/NCSD may include identifying the boundaries of the operation, identifying contingent conditions that require analysis, and other appropriate issues that require up-front clarification. The scope should be documented for complex activities (e.g., those involving specially-designed equipment or needed specially-trained personnel).

Facility Manager or Responsible Manager **10.** Review and approve the scope of the NCSE/NCSD.

NCS Engineer **11.** Develop NCSE/NCSD per PROC-NS-1005, *Nuclear Criticality Safety Evaluations and Calculations*.

C. Implementing an NCSE/NCSD

NOTE 1: The “Verification Checklist for NCS Implementation” (Form-3563) is described in Attachment D.

NOTE 2: The wording of NCS requirements in procedures or instructions does not need to match the wording in the NCSE/NCSD verbatim. Wording changes are allowed to convert the NCS limits and controls into procedural steps that are easily followed by the fissile material worker.

NOTE 3: Since no criticality controls are provided in a NCSD, an implementation to the level of NCSE requirements is not necessary. The only requirements are the NCS Engineer or CSO (1) perform a walk down of the process to ensure the process/facility description within the NCSD is accurate and complete, (2) review appropriate documentation to ensure credited conditions of operation are in place, and (3) develop a briefing at the appropriate level for the defined FMO (refer to Attachment B).

NOTE 4: Steps 1 through 13 of this section may be worked in any order or concurrently.

Facility Manager **1.** Perform NCS implementation for each location in which the FMO will be conducted.

NCS Engineer **2.** Complete an NCVC for each location for which the NCSE/NCSD is to be used.

Facility Manager **3.** **IF** implementing a new or revised NCSE/NCSD that requires changes to operating procedures or work packages or includes new design feature(s) that require a physical change to the facility, **THEN** ensure the procedure/work package revision is reviewed by appropriate USQD/Unreviewed Change Determination (UCD) prior to implementation of the NCSE/NCSD.

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NOTE 1: Not all new or revised NCSEs/NCSDs involve a procedure or facility change that may require a USQD/UCD.

NOTE 2: PROC-OS-1107, "Performance Document Process," includes a requirement that, if a performance document is a project-level document that contains or implements regulatory requirements or other commitments, then the requirement or commitment text is to be notated. For example: Implementing NCSE control text. <Source Document Number>

Responsible Manager 4. Prepare or revise FMO plans, procedures, and instructions, training modules, and other safety basis documents, as applicable, to include the NCS requirements, with assistance from the NCSO, as needed. The operational limitations, assumptions, initial conditions, and controls flowed down from NCSEs/NCSDs shall be highlighted or annotated in the work control documents.

NOTE: Participation by a CSO applies to those projects and facilities that have assigned CSOs.

Responsible Manager or NCS Staff 5. Prepare NCS Signs, Postings and Labels in accordance with Attachment C, "Standard NCS Signs, Postings and Labels." Ensure fissile material workers and their supervisors participate in developing the wording for NCSE postings.

Responsible Manager 6. Ensure safety basis documents (e.g., DSA) adequately cover the FMO and NCSE requirements (i.e., as identified in the safety basis control selection NCSR).

7. Ensure all procedures, instructions, and safety basis documents are approved and ready for implementation.

8. Schedule the NCS implementation walk down with the appropriate NCS Engineer and CSO (as applicable).

NCS Engineer or CSO (as applicable) 9. Review applicable procedures, instructions, training modules, postings, and safety basis documents to determine if NCS requirements are adequately implemented. Resolve any discrepancies with the Responsible Manager.

10. Confirm NCSE requirements and NCSD operational limitations, assumptions and initial conditions, as needed, are annotated or highlighted in all affected work control documents.

11. Perform a NCS implementation walk down with the Responsible Manager or designee to ensure the FMO is ready to implement the NCSE/NCSD. Complete an NCVC (Form-3563) for NCS as described in Attachment D. Identify acceptable installation of NCS Signs, Postings and Labels.

Responsible Manager 12. Ensure all Fissile Material Supervisors and Fissile Material Workers involved in the FMO are trained to the FMO procedures and instructions, and briefings are performed in accordance with Attachment B.

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| Responsible Manager or NCS Staff | 13. Ensure obsolete NCS Signs, Postings and Labels (if any) are removed and new NCS Signs are installed and work with Operations to ensure NCS Postings are implemented in accordance with Section D, "NCS Signs, Postings and Labels. |
| Responsible Manager | 14. Review the Implementing Actions for NCVC (as described in Attachment D) for acknowledgement of completion of the NCSE/NCSD implementation. |
| Facility Manager | 15. Review the Implementing Actions for NCVC (as described in Attachment D) for acknowledgement of completion of the NCSE/NCSD implementation. |
| NCS Manager or Designee | 16. After all required implementation actions are completed, approve the Implementing Actions for NCVC with an implementation date and transmit to the applicable NCS Engineer. |
| NCS Engineer | 17. Prepare a separate Form-554, Safety Document Worksheet, for the original, signed NCVC and transmit it to the UCOR Document Management Center (DMC). |
| Responsible Manager | 18. Initiate the FMO on or after the NCSE/NCSD implementation date. |

D. NCS Signs, Postings and Labels

NOTE: Participation by a CSO applies to those projects and facilities that have assigned CSOs.

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| Responsible Manager or NCS Staff | <ol style="list-style-type: none"> 1. Prepare NCS signs, Postings and Labels following the guidance provided in Attachment C, "Standard NCS Signs, Postings and Labels." Alternatives shall be approved by the NCS Manager prior to use. 2. Document acceptable signs, Postings and Labels in accordance with Attachment C using a NCVC. 3. Affix NCS signs, Postings and Labels on their corresponding NCSE/NCSD prior to the FMO. 4. Affix NCS signs, Postings and Labels in a manner that will not obscure controls, indications, or indicating lights.
IF using laminated paper, THEN
place the NCS Signs and Postings so they do not curl or flop and obscure the contents from clear view. 5. WHEN fissile material is permitted by an NCSE/NCSD to be stored on opposite sides of a wall or other visual obstruction, and a mass limit and/or spacing limit applies because of potential interaction, THEN
post such mass or spacing limits on both sides of the wall or obstruction. |
| NCS Engineer | 6. Assist operations personnel with wording and placement of NCS signs, Postings and Labels. |

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| Facility Manager or CSO
(as applicable) | 7. | Ensure NCS Postings are uniquely identified and controlled (e.g., operator aid logs). |
| Responsible Manager or CSO
(as applicable) | 8. | Properly position applicable NCS STORAGE ARRAY and NCS REQUIREMENTS Postings in close proximity to where they are to be used. |
| | 9. | Post FCA signs in accordance with Attachment C, “Standard NCS Signs, Postings and Labels.” |
| Responsible Manager or CSO
(as applicable) | 10. | Replace damaged, deteriorated, or missing signs, Postings and Labels as necessary. |

NOTE: Emergency Evacuation training defines evacuation routes and assembly locations.

E. Clarification of an NCSE/NCSD

NOTE 1: The NCS Clarification may be used to provide an explanation or interpretation of a control. Typically, a clarification explains why an action complies with the control set of the NCSE or assumptions of an NCSD and shall contain the basis for that conclusion. Clarifications could explain a condition in the FMO that remains within the scope and assumptions of the NCSE/NCSD or answer a question or provide further explanation of a basis statement or control from the NCSE. Clarifications shall not be used to change the intent of requirements or bases in NCS documents (i.e., NCSE or NCSD).

NOTE 2: When an NCSE/NCSD is revised, all existing clarifications to the previous revision shall be dispositioned as part of the revision process. Those clarifications that are necessary shall be incorporated into the new revision. Upon implementation, the revised NCSE/NCSD supersedes the previous revision and all clarifications associated with the previous revision.

NOTE 3: Participation by a CSO applies to those projects and facilities that have assigned CSOs.

NOTE 4: When an NCSE or NCSD has two or more NCCFs associated with it, or an NCCF is two or more years old, the NCSE or NCSD should be revised to incorporate the contents of the NCCF.

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| Responsible Manager | 1. | Request support from NCS for additional information concerning a control, basis of a control, assumption, or condition, etc., described in an NCSE/NCSD. |
| NCS Engineer | 2. | Complete a NCS Clarification Form (NCCF) (Form-3571). Ensure a basis is provided for the clarification to support its conclusion. |
| NCS Engineer Reviewer | 3. | Review the draft NCCF. Ensure the clarification addresses the concern/question and implementation of the NCSE/NCSD is not affected. |

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- Facility Manager
4. Review the draft NCCF to ensure accurate representation and description of the operation or process and acceptability of the conclusion.
 5. **IF** the NCS Clarification is NOT acceptable, **THEN** provide comments to the NCS Engineer.

- Facility Manager
6. **IF** the NCS Clarification is acceptable, **THEN** sign the NCS Clarification and transmit to the UCOR NCS Manager.

- NCS Manager or Designee
7. Review and approve the NCS Clarification or provide comments as applicable.

- NCS Engineer
8. Prepare a separate Form-554, Safety Document Worksheet, for the original, signed NCS Clarification and transmit it to the UCOR DMC.

F. Review of Work Documents

NOTE 1: NCS reviews work control documents that affect FMOs directly or indirectly.

NOTE 2: Participation by a CSO applies to those projects and facilities that have assigned CSOs.

- Responsible Manager or Planner
1. Request support from NCS to review a work document.

- NCS Engineer and CSO (as applicable)
2. Review the work document to ensure that all activities comply with existing NCSE/NCSD controls, operational limitations and assumptions.

NOTE: As part of the review process, some comments may be marked as mandatory, indicating a change is necessary to obtain NCSO approval, other may be made as suggestions for improvement only and are not necessary to address for NCSO approval.

- NCS Engineer and CSO (as applicable)
3. **IF** the work document is missing necessary controls or the controls are not properly implemented, **THEN** provide comments to Planner; or NCS Engineer if reviewed by CSO.

NOTE: As part of the review, crosswalks may be utilized. The crosswalks list all NCSEs controls and document which are applicable in a work document. This tool facilitates verification that all controls necessary are included in the work document.

- NCS Engineer
4. Compile all comments and forward to the Responsible Manager or Planner.

- Responsible Manager or Planner
5. Address any comments provided by NCS and provide a revised work document for verification of comment resolution.

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NCS Engineer and CSO (as applicable)

6. Verify all comments have been satisfactorily addressed.
7. **IF** the revised document is acceptable, **THEN** indicate that all comments have been adequately addressed. **OTHERWISE**, return to Step F.6, above.
8. **IF** crosswalk documents have been prepared, **THEN** sign crosswalks.
9. Indicate approval of work document by signing document.

G. De-Implementation of an NCSE/NCSD

NOTE 1: On occasion, it may be necessary to de-implement an NCSE/NCSD without cancelling the document (Form-3568 is the NCS DEIMP form). If an NCSE/NCSD is not currently posted/implemented anywhere, but may still be needed in the future, it may be de-implemented. If the de-implemented NCSE/NCSD is re-implemented, a new implementation is required (see What To Do, Section C).

NOTE 2: Participation by a CSO applies to those projects and facilities that have assigned CSOs.

NOTE 3: NCS de-implementation shall identify each location where the FMO will be de-implemented.

Responsible Manager

1. Request support from NCS to de-implement an NCSE/NCSD.

NCS Engineer or CSO (as applicable)

2. Complete a NCS De-Implementation Form-3568. Include any actions required for de-implementation (e.g., removal of posting/barrier removals, procedure changes, notifications, update of the NCSV master log, cancel training module(s), etc.).
3. Transmit the NCS De-Implementation Form to the Responsible Manager giving requirements for de-implementation.

Responsible Manager

4. **WHEN** all requirements for deactivation have been completed, **THEN** approve the NCS De-Implementation Form.

NCS Engineer or CSO (as applicable)

5. Confirm all requirements for de-implementation have been completed and approve the NCS De-Implementation Form.
6. Transmit the NCS De-Implementation Form to the Facility Manager and the NCS Manager.

Facility Manager and NCS Manager

7. Acknowledge completion and approve the NCS De-Implementation Form and enter the effective date for de-implementation.

Facility Manager or NCS Staff

8. Ensure the postings inventory list (as applicable) is updated to reflect removal of NCS postings, signs and labels.

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NCS Manager or Designee

9. Prepare Form-554, Safety Document Worksheet, for the original, signed NCS De-Implementation Form and transmit it to the UCOR DMC.

H. Canceling an NCSE or NCSD

NOTE: Cancellation of an NCSE or NCSD is not required when it is superseded by another NCSE or NCSD using the appropriate DMC form (Form-554).

Responsible Manager

1. Request support from NCS for cancellation of an NCSE or NCSD by initiating the NCS Cancellation Form (Form-3569).

NCS Engineer or CSO (as applicable)

2. Complete a Form-3569. Include any actions required for cancellation (posting/barrier removals, procedure changes, notifications, training module(s), etc.).
3. Transmit the Form-3569 to the Responsible Manager giving requirements for canceling the NCSE/NCSD.

Responsible Manager

4. **WHEN** all requirements for canceling the NCSE/NCSD have been completed, **THEN** approve the Form-3569.

NCS Engineer

5. Confirm all requirements for canceling the NCSE/NCSD have been completed and approve the Form-3569.
6. Transmit the Form-3569 to the Facility Manager and the NCS Manager.

Facility Manager and NCS Manager

7. Acknowledge and approve the Form-3569.

NCS Engineer

8. Prepare Form-554, Safety Document Worksheet, and transmit the Form-3569 to the UCOR DMC for distribution of cancellation notification

I. NCS Exemption Documentation

NOTE: The NCS exemption (NCEX) form (Form-3567) may be used to document a facility/area NCS exemption. An NCEX provides a detailed summary of the NCS exemption being implemented and the justification for citing that particular exemption.

NCS Engineer

1. Complete a NCEX form. Ensure a justification is included to support its conclusions.

NCS Engineer Reviewer

2. Review the draft NCEX form. Ensure the data used to determine the exemption is adequate and that it is properly documented.
3. **IF** the NCEX is NOT acceptable, **THEN** provide comments to the NCS Engineer.
4. **IF** the NCEX is acceptable, **THEN** sign the NCEX and transmit to the NCS Manager.

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NCS Manager or Designee

5. Review and approve the NCEX or provide comments as applicable.

NCS Engineer

6. Prepare Form-554, Safety Document Worksheet, and transmit the Form-3567 to the UCOR DMC

J. Performing Periodic NCS Surveillances

NOTE 1: NCS surveillances are performed to serve three (3) main functions. The first function is to ensure that periodic reviews of FMOs are conducted to meet, as a minimum, the ANSI/ANS-8.19 annual review requirements ensuring process conditions have not been altered to affect the NCSD/NCSE of the FMO. The second function is to document periodic inspections of NCS items (e.g., material containers, storage arrays and cabinets, safe vacuums, etc.) credited as Design Features in facility safety basis documents (denoted by: <TSR/DSA>). The third function of the NCS surveillances is to perform two important Integrated Safety Management System (ISMS) elements: “Analyze the Hazards” and “Provide Feedback and Continuous Improvement.” These are addressed through observing the FMO, thus discovering potential new hazards and discussing the FMO with the operators.

NOTE 2: Each FMO must be reviewed on an annual basis. For those NCSEs/NCSDs governing multiple facilities, each facility must be reviewed on an annual basis at a minimum. Each individual NCS surveillance is not required to cover all facilities governed by the NCSE/NCSD.

NOTE 3: NCS surveillances should be conducted during both periods of active FMO, if possible, as well as static storage conditions.

NOTE 4: Dependent on NCS staffing, the NCS surveillance should be performed by an NCS Engineer who did not author the current revision of the NCSE/NCSD governing the FMO.

NOTE 5: Since no criticality controls are provided in a NCSD, the surveillance requirements for a NCSD are not as detailed as for an NCSE. The NCS Engineer shall perform a walk down of the process to ensure the process/facility description within the NCSD matches current operating activities, and any assumptions, operational limitations, and/or initial conditions made within the NCSD remain valid or justify why a walk down is not performed.

NOTE 6: If a new or revised NCSE/NCSD is implemented for the FMO, the annual NCS surveillance requirement is satisfied by performance of implementation. NCS Manager concurrence is necessary to delay an NCS surveillance in the event NCS documents for an FMO are being revised.

NOTE 7: No NCS surveillance is required for de-implemented NCSEs/NCSDs.

NCS Manager or Designee

1. Schedule NCS surveillances to be performed.

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NCS Engineer or
CSO
(as applicable)

2. Coordinate the schedule with the Facility Manager and Responsible Manager (through the Subcontract Coordinator/Subcontract Technical Representative, as applicable) for the FMO being surveilled.
3. Prior to the NCS surveillance, review the previous NCS surveillance documentation, implementation checklist, associated ACRs, and previous corrective actions.
4. Prior to the NCS surveillance, as a minimum, perform a review of the FMO System/Process Description, Design Features, Administrative Limits, Controls and Operational Limitations noted in the associated NCSE/NCSD.
5. Invite the Facility Manager, Responsible Manager, and operations staff as appropriate, to participate in the walk down.
6. Perform as appropriate each of the following for the aspects of the FMO being evaluated:
 - a. Review the appropriate operating procedures or work packages for correct flow down of NCS requirements.
 - b. Observe postings, labels, barriers, spacing, and stacking for compliance with the NCSE/NCSD.
 - c. Observe the FMO for any deviations from the FMO System/Process description in the NCSE/NCSD and determine if deviations are significant to the analyses.
 - d. Observe the FMO for operator compliance with operating procedures and NCS postings.
 - e. Discuss the FMO with the operations staff as appropriate to determine and ensure their understanding of NCS requirements and to become aware of any NCS concerns and possible alternative requirements to assist operations in the performance of their task.

NOTE: The documentation review of fissile material stored within each facility is not required to encompass 100% of the containers/equipment within the facility. Engineering judgment should be used to determine the appropriate percentage of fissile material storage documentation to be reviewed.

NCS Engineer or
CSO
(as applicable)

- f. Review documentation of the fissile material associated with each facility governed by the NCSE/NCSD.
- g. Review operation's documentation of NCSE/NCSD specific training for the NCSE/NCSD being surveilled.
7. Evaluate whether the FMO could be performed under an NCSD and whether the associated NCSE could be cancelled.

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| NCS Engineer or CSO
(as applicable) | <p>8. Handle any NCS Anomalous Conditions identified during the course of the NCS surveillance in accordance with Section K, "Response to Anomalous Conditions."</p> <p>9. Document the results of the NCS surveillance in an NCS Surveillance Report (NCSV) (Form-3564; see Attachment E for guidance) and obtain the appropriate reviews and signatures.</p> |
| NCS Engineer | <p>10. Prepare Form-554, Safety Document Worksheet, and transmit the original, signed NCS Surveillance Report to the UCOR DMC for retention. Transmit a copy to the Facility Manager and the Responsible Manager for information.</p> |

K. Response to Anomalous Conditions

- NOTE 1:** During Anomalous Conditions requiring time-urgent response, NCS recommendations may need to be given before all steps of this procedure can be performed.
- NOTE 2:** This procedure does not replace normal emergency response actions to plant alarms/emergencies. In an emergency situation, NCS guidance may be given outside the process of routine NCS document generation by a facility or FMO cognizant NCS Engineer, Senior NCS Engineer, or NCS Manager. If verbal guidance is provided, documentation of the guidance will be prepared within 48 hours after the emergency condition has been stabilized.
- NOTE 3:** From the NCS Anomalous Condition Report Form (Form-3565), Level 5 Anomalous Conditions are defined as "Administrative errors (NCS postings, implementing procedures, labeling, barriers, etc.), changes in facility conditions such as rainwater in-leakage, or other abnormal conditions that do not impact any criticality safety bases, but warrant review by NCS". Therefore, throughout this section, special allowances are made to streamline the process for responding to these conditions which present little or no additional risk to the workers, the public, or the equipment. Also, Level 5 Anomalous Conditions may be closed in the Issues Management System without the identification of recurrence prevention measures.
- NOTE 4:** This section is also applicable when an NCSE/NCSD does not exist and an FMO is being performed.
- NOTE 5:** Declaring an ACR is not seen as a negative for a project. An ACR means there is an unanalyzed process condition or an as-found condition that needs to be further reviewed. If the ACR process is entered due to a possible ACR and upon further investigation it is determined there is no ACR, NCS simply notifies the Facility Manager that any postings/barriers can be removed and normal operations can proceed.

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NOTE 6: Before entering into the ACR process, Facility Managers are given a “discovery” period to determine if the as found condition is not adequately covered by an NCSE/NCSD or other applicable NCS documentation. This discovery period can also be used to determine if an undocumented container may contain any fissile material. The discovery period is entered after the initial stop work by the worker and the stop work orders by the Facility Manager.

NOTE 7: Postings and barriers shall be used to isolate the discovered material/item until the anomalous condition is confirmed or information gathered can be used to determine the discovery does not constitute an anomalous condition.

NOTE 8: Discoveries of anomalous items/conditions in facilities documented to meet an NCS programmatic exemption (Attachment H or NCEX), will be managed through the UCOR Unreviewed Change (UC) program, if subcriticality can be easily determined (i.e., equivalent to a deficiency). If subcriticality cannot be easily determined (i.e., equivalent to an infraction), then an ACR will be established.

Worker

1. **IF** an NCSE requirement is violated or appears to have been violated,

OR

IF procedural deviations or unforeseen alterations in process conditions affect NCS,

OR

IF an as-found condition appears to contain fissile material or displays characteristics (e.g., elevated dose rate, fissile labels) that has not been analyzed by NCS,

AND IF it cannot immediately be determined that the severity level of the Anomalous Conditions is no more severe than a level 5, **THEN:**

- a. Immediately stop work.
- b. Isolate personnel from the immediate area by at least 15 ft, and report the condition to the Responsible Manager or supervisor of the FMO, or NCS.

NOTE 1: **DO NOT** attempt to correct the situation without direction from the Facility Manager or Plant Shift Superintendent (PSS)/Laboratory Shift Superintendent (LSS)/Emergency Services Watch Office (ESWO), **AND** written guidance from the NCS Manager or designee (except as allowed in Steps 2 and 7.b). Written guidance from the NCS Manager or designee is usually captured in the ACR generated in accordance with subsequent steps in this procedure. If circumstances require more immediate action, the NCS Manager or designee, FMO cognizant NCS Engineer, or Senior NCS Engineer can issue written approval prior to completion of the ACR, but the approval must include a description of the basis for safety of the activity and should be discussed in the ACR subsequently prepared.

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NOTE 2: Steps K.2 through K.20 do not need to be performed in the order as written if a more logical progression is acceptable dependent on each situation as through convenience or as dictated to ensure safety.

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| Facility Manager | <p>2. IF the condition cannot be evaluated immediately and shown to be in a safe condition, THEN
perform steps 1a and 1b, if not already completed by a worker,
AND
begin the “discovery” period to determine if the as found condition constitutes as an ACR.</p> |
| CSO (as applicable) or Responsible Manager or Supervisor | <p>3. IF the event is obviously no more severe than a Level 5 Anomalous Condition, THEN
notify NCS personnel and upon verbal approval from an NCS Engineer, Senior NCS Engineer, or NCS Manager, initiate correction of the Anomalous Condition, notify the Facility Manager, and go directly to Step 21 of this section.</p> <p>4. Notify the Facility Manager and NCS personnel.</p> |
| NCS Engineer | <p>5. Promptly inform the appropriate APM and the NCS Manager.</p> <p>6. IF conditions relevant to NCS are unstable, THEN
provide the Facility Manager and the PSS/LSS/ESWO with guidance to stabilize the situation, if possible.</p> <p>7. IF conditions warrant a boundary distance other than 15 feet, THEN
provide justification, with emphasis on safety, for the alternate boundary distance. This justification shall be included in or attached to the ACR form when it is written.</p> |
| Facility Manager or Responsible Manager | <p>8. IF an ACR is determined to be required, THEN
establish a physical, administrative, or natural boundary at least 15 ft from the affected fissile material, unless directed otherwise by an NCS Engineer or NCS Manager.</p> <p>a. IF the layout of the area around the affected fissile material is such that evacuation from the area is difficult due to clutter, other equipment, etc., THEN
establish the boundary at the outer edge of such areas, even if doing so increases the distance between the boundary and the affected fissile material to over 15 ft.</p> <p>b. Upon review, walk down, and concurrence by the CSO or NCS Engineer, corrective action may be initiated as warranted to achieve a safe/compliant condition when the recommended action clearly would have no adverse effect on system reactivity (i.e., seal or cover process gas openings, close open containers, etc.). Safe configuration actions will be documented in the ACR form.</p> |

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Facility Manager or Responsible Manager

- c. **IF** the area is to be left unattended, **THEN** include a posting at the boundary that identifies the area as an NCS Anomalous Condition (refer to Attachment C). The posting shall specify any required restrictions on activities or entry into the area.

NOTE: Permission to enter the affected area does not include permission to perform activities to bring the operation back into compliance or to correct the Anomalous Condition, or permission to move fissile material within the affected area.

Facility Manager or Responsible Manager

- d. Entrance into the posted area by personnel other than the Facility Manager or NCS personnel requires written permission from the NCS Manager or NCS Engineer, or escort by the Facility Manager, NCS Manager, NCS Engineer or CSO (if applicable) that is familiar with the operation and the Anomalous Condition.

9. Notify the PSS, LSS or ESWO.

10. Provide available details to NCS personnel for use in technically evaluating the situation.

NCS Engineer

11. **IF** the event involves the potential violation of a NCSE limit or control or a potential unanalyzed or unapproved FMO, **THEN** ensure Steps K.1 through K.7 have been performed.
12. **IF** no NCSE or NCSD applies to the FMO in question, or the as-found condition is unanalyzed, **THEN** ensure the Facility Manager directs the shutdown of the operation, unless doing so would result in an increased risk to safety and health of personnel or a decreased margin of safety for that activity.
13. **IF** an NCSE or NCSD is deficient:
- a. **IF** the deficiency invalidates the entire analysis and the operation has not been shutdown, **THEN** direct shutdown of the operation in writing, unless doing so would result in an increased risk to safety and health of personnel or a decreased margin of safety for that activity.
 - b. **IF** the deficiency affects only part of the analysis, **THEN** the NCS Engineer may exercise judgment in recommending to the Facility Manager and the PSS/LSS/ESWO that only the affected part of the operation needs to be shut down. Partial shutdown of an operation may be accomplished using stop work actions or procedure holds.
14. **IF** the deficiency affects only part of an NCS analysis and only partial operation shutdown is occurring, **THEN** obtain NCS Manager or Designee concurrence to maintain partial operation. Justification for maintaining partial operation shall be documented in the ACR.

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NOTE: For determining ACR severity level, refer to Form-3565, NCS Anomalous Condition Report, Table F-1, for guidance. Base decision on documented NCSE/NCSD. However, consider other known factors or conditions. For instance, the NCSE basis most likely only considers a mass based on 100 wt % enrichment such that higher mass values may be acceptable at lower enrichments. Small amounts of accumulated fissile materials may also be credited as favorable geometry provided that the containment device does not allow entry of additional fissile or moderating materials.

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| NCS Engineer | 15. Determine impact on double contingency or incredibility and recommend an ACR severity level to the NCS Manager or Designee. |
| NCS Manager | 16. Notify the TENS Manager and the Nuclear and Criticality Safety Manager. |
| NCS Engineer or
NCS Manager | 17. Support the Facility Manager and the PSS/LSS/ESWO in determining reportability and report Anomalous Conditions according to occurrence reporting procedures. Nuclear Safety may need to be consulted to help determine whether the Anomalous Condition also constitutes a TSR violation or Unreviewed Safety Question (USQ). |
| | NOTE: NCS Manager or Designee shall approve all compensatory and corrective actions (other than immediate actions to ensure a safe configuration or those actions verbally approved by an NCS Engineer, Senior NCS Engineer, or NCS Manager for Anomalous Conditions determined to be Level 5 severity or actions taken in Step 7b). |
| NCS Engineer or
NCS Manager | 18. Coordinate with the Facility Manager/Responsible Manager to determine the corrective actions necessary to correct the specific condition, as well as any compensatory actions that are required until the condition-specific corrective actions can be completed. |
| | 19. Obtain the ACR number and initiate the ACR documentation process using Form-3565. The ACR number format is specified in PROC-OS-1004, <i>Document Numbering and Issuance</i> . |
| Facility Manager and
NCS Engineer | 20. Gather information pertinent to the Anomalous Condition via fact finding meetings and critiques and site visits, as required. Examples of pertinent information may include the following: <ul style="list-style-type: none"> • Material involved, • Mass and configuration of the material, • Enrichment, • Any potential moderators, • Conditions and stability of the scene, • Spacing between fissile or potentially fissile materials involved, • Other hazards (e.g., UF₆ release), • Possible process upsets, • Time of occurrence, • Time of discovery, • What NCSE or NCSD (if any) covers activity, • Building/area involved, • Activity being performed. |

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- NCS Engineer
21. Support the Facility Manager by reviewing any safety basis documents, including USQDs, as required.
 22. Complete the ACR (Form-3565) to include condition corrective actions necessary to correct the condition as well as any compensatory measures/actions that may be required until compliance is reestablished. If the anomalous condition is determined to be reportable, the NCS ACR may be used as an aid in reporting the event.
 23. Complete Anomalous Condition Report Addendum (Form-3570) as necessary to document updated field conditions for closure.
 24. Obtain the appropriate reviews and signatures (NCS Manager or Designee, CSO (as applicable), and Responsible Manager) on the ACR and any subsequent addenda.
- Facility Manager and NCS Engineer
25. Provide direction to implement and perform the required condition-specific corrective action(s) as provided in the ACR.
- NCS Engineer or NCS Manager
26. Perform a generic implications review of the condition to determine whether the identified anomaly affects the assumptions (e.g., assumed error frequencies) in any other NCS documents.
 27. Ensure identified actions are sufficient to correct the observed field condition.
 28. Sanitize copies of each ACR and addenda to remove Official Use Only (OUO) details/information and transmit to Issues Management for entry into the issues management system.
 29. Complete Form-554, Safety Document Worksheet, and transmit the original, signed NCS ACR (Form-3565) and ACR addendum(s) (Form-3570) to the UCOR DMC for retention. Transmit copies to the Facility Manager and the Responsible Manager for information.
 30. **WHEN** all condition-specific corrective actions (i.e., those actions necessary to restore compliance in the field) are complete, **THEN** close the ACR by indicating it as closed on the ACR Log on the NCS SharePoint Website. Also, identify and record any issues management system reference identification numbers.

L. Response to a Criticality Event

NOTE: An actual criticality will result in activation of the EOC. This procedure **DOES NOT** supersede any emergency response procedures.

- NCS Engineer and NCS Manager
1. The EOC NCS Representative or any other qualified NCS Engineer may perform the following action steps to provide support to the EOC.

IF a criticality event is confirmed, **THEN** the following shall be performed:

 - a. Respond to the EOC, PSS/LSS/ESWO, or Incident Commander Location as requested.

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NCS Engineer and
NCS Manager

- b.** Gather information on criticality as it becomes available, such as:
- Number of alarms,
 - Location of alarms,
 - Type, enrichment, and quantity of material in area,
 - Nature or form of the fissile material such as liquid or powder,
 - Geometrical configuration of the fissile material,
 - Work being performed in area at time of occurrence,
 - Reports of possible cause from scene,
 - Radiation readings obtained by plant emergency personnel at scene,
 - Evacuee dosimeter readings and location at the time of the incident.
2. Based on available information, attempt to determine possible cause and location of criticality.
 3. **IF** possible cause of criticality has been determined, **THEN** attempt to determine whether further accumulation of fissile material may occur.
 4. Based on available information, attempt to determine whether any of the current conditions are changing.
 5. Based on available information, attempt to determine whether any of the current conditions (e.g., agitation) are adding to, or limiting the event.
 6. Evaluate event situation for possible recurring or sustained criticality.
 7. **IF** recurring or sustained criticality is possible, **THEN** inform the EOC and provide recommendations to prevent reoccurrence.
 8. Evaluate how best to stabilize the conditions in the area to avoid making the situation worse.
 9. Evaluate whether fissile material can be drained or removed from the area.
 10. **IF** a reflector or moderator is present, **THEN** determine whether the reflector or moderator can be remotely removed.
 11. Estimate the fission yield of the criticality using references such as NUREG/CR-6504, Vol. 2, *An Updated Nuclear Criticality Safety Slide Rule*, and provide results to management, as time permits.
 12. Complete a NCS ACR per Section K, "Response to Anomalous Conditions."

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M. Trending and Tracking of NCS Anomalous Conditions

NCS Manager or Designee

1. On a periodic basis, and at least once every calendar year, trend the NCS Anomalous Conditions to provide data for improvement in the NCSP.

RECORDS

NOTE: The UCOR NCS group uses the NCS SharePoint site (*ncs-sp.ettp.gov*) to store and access working drafts, final word versions, and signed versions of many of the records listed below. It is the responsibility of the user to verify the version being reviewed is the appropriate version for each application. The SharePoint site **SHALL NOT** be used as a substitute for compliance with Document Control requirements.

NCS records shall be maintained in accordance with UCOR procedures during the period of their applicability. Records generated by this procedure and listed below shall be dispositioned in accordance with PROC-OS-1001, *Records Management, Including Document Control*. A completed Form-554, Safety Document Worksheet, must accompany all NCS documents to the UCOR DMC. Examples of such records include:

- NCS Training Records
- NCS Training Modules
- NCS Engineers and CSOs Qualification Records
- NCS evaluations, NCS determinations, NCS reports
- Form-3563, Verification Checklist for NCSE/NCSD Implementation
- Form-3564, NCS Surveillance Report
- Form-3565, Anomalous Conditions Report
- Form-3566, NCS Request and Scope Form
- Form-3567, NCS Exemption Form
- Form-3568, De-implementation Form
- Form-3569, NCS Cancellation Form
- Form-3570, Anomalous Conditions Report Addendum
- Form-3571, NCS Clarification Form

SOURCE DOCUMENTS

NOTE: The UCOR Project Contract requires that for consensus standards that are not incorporated by reference (e.g., ANSI/ANS-8 series), operation and maintenance activities will be performed to the current revision of the standard.

- 10 CFR 830 Subpart A, Quality Assurance Requirements
- ANSI/ANS-8.1-2014; R2018, *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*
- ANSI/ANS-8.3-1997; R2017, *Criticality Accident Alarm System*
- ANSI/ANS-8.7-1998; R2017, *Nuclear Criticality Safety in the Storage of Fissile Materials*
- ANSI/ANS-8.15-2014; R2019, *Nuclear Criticality Control of Special Actinide Elements*
- ANSI/ANS-8.19-2014; R2019, *Administrative Practices for Nuclear Criticality Safety*
- ANSI/ANS-8.20-1991; R2020, *Nuclear Criticality Safety Training*

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- ANSI/ANS-8.21-1995; R2019, *Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors*
- ANSI/ANS-8.22-1997; R2021, *Nuclear Criticality Safety Based on Limiting and Controlling Moderators*
- ANSI/ANS-8.23-2019, *Nuclear Criticality Accident Emergency Planning and Response*
- ANSI/ANS-8.24-2017, *Validation of Neutron Transport Methods for Nuclear Criticality Safety Calculations*
- ANSI/ANS-8.26-2007; R2022, *Criticality Safety Engineer Training and Qualification Program*
- DOE O 420.1C, Chg. 3, *Facility Safety*
- DOE O 426.2, Chg. 1, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*
- DOE-STD-3007-2017, *Preparing Criticality Safety Evaluations at Department of Energy Nonreactor Facilities*
- NCSD-SM-01-0011, *Fissionable Exempt Material Determination*
- NCSD-YT-EMWWMF-0057, *Beryllium Considerations at the EMWWMF*
- NCSE-MS-NTS-1492, *NCSE for Emplacement of ORR Waste at Nevada Test Site*
- NCSR-MS-DEMIN-0064, *Deminimus Threshold for Fissionable Materials*
- NUREG/CR-6504, Vol. 2, *An Updated Nuclear Criticality Safety Slide Rule*
- PROC-OS-1001, *Records Management, Including Document Control*
- PROC-OS-1004, *Document Numbering and Issuance*
- PROC-OS-1107, *Performance Document Process*
- PROC-PQ-1220, *Occurrence Notification and Reporting*

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Attachment A
Definitions/Acronyms
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ACR – Anomalous Condition Report

Annually – A period of time defined as every 12 months \pm 90 days.

Anomalous Condition – An unusual or abnormal condition where an NCS infraction of procedures, violation, or deficiency may be present.

APM – Area Project Manager

Barrier – A set of NCS controls used to prevent (or protect against) the occurrence of a contingency.

Criticality Accident Alarm System (CAAS) – A system capable of providing an immediate emergency evacuation alarm signal (usually audible but may be visual) after detecting a criticality accident (usually by the detection of gamma and/or neutron radiation).

Criticality Safety Review Committee (CSRC) – A committee that provides an independent appraisal of the NCSP to UCOR management and whose membership is established by the NCS Manager.

Contingency – A possible but unlikely change in a condition/control important to the NCS of an FMO. If a contingency occurs, the number of barriers (either administrative or physical) that are intended to prevent a nuclear criticality excursion is reduced.

CSO – Criticality Safety Officer

D&D – Decontamination and Decommissioning

Double Contingency Principle – Process designs should incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible. As written, the principle says nothing about controls. It neither endorses nor discourages the use of multiple controls on a single process condition to ensure subcriticality. The intent is simply to ensure that no single change in a process condition could result in a criticality accident (i.e., at least two or more changes in process conditions that are independent from each other must occur concurrently before a criticality accident is possible). If any single credible change in a process condition can result in a criticality accident, then adherence to the Double Contingency Principle as stated cannot be claimed.

DMC – Document Management Center

DOE – U.S. Department of Energy

DOT – U.S. Department of Transportation

DSA – Documented Safety Analysis

Enriched Uranium – Uranium compounds containing ^{235}U in a weight percentage greater than 0.71 % on a total uranium basis.

EOC – Emergency Operations Center

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ESWO – Emergency Services Watch Office

Fissile Control Area (FCA) – A designated area where a fissile material operation occurs. Fissile Control Areas are identified by posting the Fissile Control Area sign, Attachment C.

Fissile Exempt – Any material satisfying the exemptions listed in Attachment H. For example, fissile material in such small quantities that no operator controls are required and criticality is not a credible risk. A container may be labeled “Fissile Exempt” under these circumstances. This definition is synonymous with “NCS Exempt” or “Non Fissile.” Fissile Exempt materials do not require a NCSD or NCSE, but are still subject to applicable requirements in the NCS Program.

Fissile/Fissionable Material – Any material capable of supporting a self-sustaining neutron chain reaction. The term fissile has strict technical definition related to the energy of a neutron causing fission (thermal energy neutrons), and this definition is met by ^{233}U , U enriched in ^{235}U , ^{232}U , ^{239}Pu , ^{241}Pu , $^{242\text{m}}\text{Am}$, ^{243}Cm , ^{245}Cm , ^{247}Cm , ^{249}Cf and ^{251}Cf . Fissionable nuclides or materials are materials in which a self-sustaining, neutron-induced fission chain reaction can occur, either by fast or thermal energy neutrons. These nuclides include all fissile nuclides. The terms “fissionable” and “fissile” are used interchangeably, but conformance with established terminology used in these definitions is recommended (e.g., Fissile Control Area, Fissionable Equivalent Mass, etc.). The following fissionable nuclides are also controlled in the UCOR NCSP, ^{234}U , ^{237}Np , ^{236}Pu , ^{238}Pu , ^{240}Pu , ^{242}Pu , ^{241}Am , ^{243}Am , ^{242}Cm , ^{244}Cm , and ^{246}Cm . The terms “fissionable” and “fissile” are used interchangeably, but conformance with established terminology used in these definitions is recommended (e.g., Fissile Control Area, Fissionable Equivalent Mass, etc.).

Fissile Material Container – A vessel specified for storage of fissile material.

Fissile Material Operation (FMO) – Operations that involve the movement, storage, transfer, mixing, packaging, or configuration control change of non-exempt fissile materials. An operation with non-exempt fissile materials sealed in DOT/DOE/NRC-approved containers and packaging that are specification packages or packages supported by a Safety Analysis Report for Packaging (SARP) shall be considered an FMO until the packages are loaded onto a transport vehicle. Once the packages are loaded onto the vehicle in accordance with the Certificate of Compliance for the package, they are covered by the safety basis supporting transport (in the Code of Federal Regulations or the SARP) and no longer require an explicit NCSE/NCSD.

Fissile Storage Array/Area – Part of the fissile control area designated for storage of fissile material containers.

Fissionable Equivalent Mass (FEM) – The total mass of any aggregation of fissile/fissionable materials expressed in terms of ^{235}U mass. In some cases, depending on the operation, the fissile material, and the NCS analysis, FEM can be converted to ^{239}Pu fissile gram equivalent (FGE) or a ^{233}U equivalency. This conversion is done by dividing the FEM by the f_{35} (see Attachment H, Table 1) for either ^{239}Pu or ^{233}U , as applicable.

Fissile Gram Equivalent (FGE) – The total mass of any aggregation of fissile/fissionable materials expressed in terms of ^{239}Pu mass.

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Fissionable Material Control Limit (FMCL) – The Fissionable Material Control Limit defines the maximum amount of fissionable material that can be present in a facility without formal NCS approval. For individual fissionable nuclides, the FMCLs are given in Table 1 of Attachment H of this procedure. The FMCLs for the different fissionable nuclides are chosen to be small enough that no credible combination of unplanned circumstances could lead to a criticality accident under the conditions possible at UCOR Facilities.

Geometrically Favorable Container – Container with dimensions and/or volume less than the single parameter limits identified in ANSI/ANS 8.1. A geometrically favorable container may be defined with stated restrictions.

Immediate Evacuation Zone (IEZ) – The area involved in an FMO that has the potential to exceed radiation exposure levels of 12 RADs.

Incredibility – Sometimes referred to as Criticality Incredible (CI), pertains to the possibility of a criticality accident during normal and upset conditions being not credible. NCSEs analyze FMOs that may require controls in order to maintain that a criticality during upset conditions will remain incredible. NCSDs analyze FMOs and take credit for operational limitations and assumptions to maintain that a criticality remains incredible. Incredible or not credible, does not mean “not possible.” A criticality during an FMO that contains enough fissile mass to sustain a criticality is possible at UCOR facilities. NCS analyzes the operations and either based on controls or operational limitations/assumptions builds a case that the FMO will remain incredible during normal and upset conditions. Inadequate knowledge of the FMO or incorrect assumptions could mean that the operational situation is different than the analyzed one; this could lead to a criticality.

ISMS – Integrated Safety Management System

LSS – Laboratory Shift Superintendent

Minimum Critical Mass – Historically, the minimum mass of fissile material, at a given enrichment, that can sustain a neutron chain reaction under optimum geometry (sphere), moderation (water), and reflection (30 cm of water).

Nuclear Criticality Accident – An uncontrolled neutron chain reaction in which heat and large, potentially lethal amounts of radiation are emitted.

NCCF – Nuclear Criticality Safety Clarification

Nuclear Criticality Safety Exemption (NCEX) – A form that documents an NCS exemption. The form could describe the basis for an NCS exemption of a facility/area, or an exemption from a part of the NCS Program (i.e., training requirements).

Nuclear Criticality Safety (NCS) – The practice of taking appropriate actions to prevent a nuclear criticality accident and to mitigate the consequences of the accident, preferably by prevention.

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NCS Deficiency – A Level 4 or Level 5 Anomalous Condition.

NCS Determination (NCSD) – A formal written document that establishes the basis for not requiring NCS controls internal to the FMO.

NCS Evaluation (NCSE) – The process that demonstrates that an FMO remains subcritical following any single credible (offering reasonable grounds for being believed) contingency or that a document’s criticality is not credible using controls internal to the FMO. This document also states the NCS safety limits and controls for the particular activity.

NCS Sign – An administrative supplement that indicates the presence of fissile material, summarizes general NCS requirements, designates fissile material work and storage areas, or provides warning to personnel.

NCS Posting – An administrative supplement that summarizes key nuclear criticality safety requirements and limits from an NCS Evaluation. Also communicates restrictions or limitations on discovery of an Anomalous Condition.

NCS Exempt – Any material satisfying the exemptions listed in Attachment H. For example, fissile material in such small quantities that no operator controls are required and criticality is not a credible risk. A container may be labeled “NCS Exempt” under these circumstances. This definition is synonymous with “Fissile Exempt.” NCS Exempt materials do not require a NCSD or NCSE, but are still subject to applicable requirements in the NCS Program.

NCS Infraction – A Level 1, Level 2, or Level 3 Anomalous Condition.

NCSO – Nuclear Criticality Safety Organization

NCSP – Nuclear Criticality Safety Program

NCS Report (NCSR) – A report that documents NCS-related information that is not appropriate for an NCSE or NCSD, and may include NCS calculations and calculational methodology used to support an NCSE or safety basis document, or provide a link between an NCSE (or series of NCSEs) and Safety Basis documentation (such as a DSA).

NCS Surveillance (NCSV) – An evaluation performed at least annually by NCS personnel in concert with Operations staff to confirm that an FMO complies with the analysis documented and NCSE requirements and selected NCSD operational limitations are being met. The expectation is that the surveillance is started early enough to anticipate completion by 12 months after implementation or completion of the previous surveillance.

NCVC – Nuclear Criticality Verification Checklist

NS – Nuclear Safety

NRC – Nuclear Regulatory Commission

OREM – Oak Ridge Office of Environmental Management

OUO – Official Use Only

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Attachment A
Definitions/Acronyms
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Peer Reviewer – A Senior NCS Engineer not directly involved in the development of the document, who examines applicable NCS documents for technical accuracy, reasonableness of method and assumptions, clarity, and consistency with applicable requirements.

PM – Project Manager

PSS – Plant Shift Superintendent

QA – Quality Assurance

Worker – Personnel who have unescorted access to or authority to provide escort within areas containing FMOs. The terms workers, fissile workers, waste handlers, and fissile material workers are used interchangeably throughout this procedure. DOE certified fissile material handlers are discussed separately throughout this procedure; however, they are also considered “workers”.

Quarterly – A period of time defined as every 3 months \pm 23 days.

Responsible Manager – An individual with responsibility of a specific program or administrative function that covers an FMO.

SARP – Safety Analysis Report for Packaging

SBRB – Safety Basis Review Board

SME – Subject Matter Expert

Supermoderation – Refers to moderation by materials whose moderation properties are more effective than those of water, such as heavy water, oil, polyethylene, beryllium, and carbon.

Super/Special Reflection – Refers to neutron reflection by materials whose neutron reflective properties are more effective than water or standard types of concrete, such as beryllium or high-density concrete.

TENS – Technical, Engineering, and Nuclear Safety

TSR – Technical Safety Requirement

USQ – Unreviewed Safety Question

UCOR – United Cleanup Oak Ridge LLC

USQD – Unreviewed Safety Question Determination

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Attachment B
NCS Training
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1.0 Requirements

1. NCSE Briefings shall be developed utilizing the guidance provided below. Personnel involved in implementing the controls shall complete the briefing. Retraining is required, as a minimum, every two years.

NOTE 1: Full training and/or an exam may be given for any situation at the discretion of the NCS Engineer.

NOTE 2: In ALL cases, training rosters are required to document (e.g., via a file maintained by the job supervisor, entry into the LEARN database, etc.) that a person meets the training requirements.

NOTE 3: When the controls from an NCSE are implemented in different work packages or procedures, it is not necessary to give the NCSE specific training module with an exam for each work package or procedure implementation. Only a briefing is required to point out to the workers the specific locations of the NCSE controls for differing implementation of an NCSE within work packages or procedures. This situation is only valid for cases where the workers have been trained previously using the NCSE specific training module and exam.

- a. Full training (i.e., following the NCSE training content requirements given in Section 2.0 below) and an exam will be given for the following situations:
 - The release of a Revision 0 to an NCSE or the first-time training on an NCSE for a worker,
 - Changes to NCS limits (e.g., a mass limit changes from 350 g to 200 g),
 - Changes to passive design features or NCS controls that are specifically identified in the TSR,
 - Major changes to multiple (i.e., more than one) NCS controls (this is determined by the NCS Engineer or NCS Lead).
- b. Full training will be given (with emphasis on the nature of the changes, and briefing on the remainder of the NCSE training module), but an exam is not necessarily required for:
 - Major changes to a single NCS control (a major change is determined by the NCS Engineer or NCS Lead),
 - Revisions to NCSEs that add new controls,
 - Revisions to NCSEs that add, delete, or change existing passive design features.

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- c. An informal briefing (e.g., pre-job brief) may be given in lieu of formal training for:
- Clarification changes to existing controls or bases,
 - Wording revisions to Postings,
 - Wording revisions to controls as stated in work packages or procedures (i.e., a control in a work package or procedure may be reworded, but the NCSE did not change),
 - Revisions that delete controls,
 - Revisions to Scope or Normal/Contingency analyses in the NCSE that do not change controls.
2. For NCSDs, the appropriate level of briefing shall be determined during the implementation process. To determine the appropriate level of the briefing and the personnel (by job function) required to be briefed, a graded approach shall be used based upon the credited assumptions and personnel control of these assumptions. The briefing may range from required reading to formal training similar to that given for NCSEs. The personnel filling the job functions identified as being required to receive the briefing shall be re-briefed at a minimum frequency of every two years.
 3. Personnel who perform fissile material operations shall complete UCOR NCS Fundamentals (or UCOR approved equivalent) and the appropriate NCSE Briefing(s). Retraining is required, as a minimum, every two years for both the module and briefing(s).
 4. Personnel who supervise fissile material operations shall complete UCOR NCS for Supervisors (or UCOR approved equivalent) and the appropriate NCSE Briefing(s). Retraining is required, as a minimum, every two years for both the module and briefing(s).
 5. Personnel who are APMs, or in any other management position dealing with any operational or programmatic involvement in NCS shall complete UCOR Nuclear Criticality Safety for Supervisors (or UCOR approved equivalent). Retraining is required, as a minimum, every two years.
 6. Personnel who do not perform or supervise fissile material operations, but enter FMO areas (i.e., governed by an NCSD or NCSE) without escort shall complete UCOR Nuclear Criticality Safety for Support Personnel (or UCOR approved equivalent). Retraining is required, as a minimum, every two years.
 7. Personnel who escort personnel into NCSE posted areas shall complete UCOR Nuclear Criticality Safety for Support Personnel (or UCOR approved equivalent). Retraining is required, as a minimum, every two years.
 8. NCS Professionals shall be qualified in accordance with UCOR-4113, *UCOR LLC Nuclear and Radiological Facilities Qualification Standard, Oak Ridge, Tennessee*.
 9. NCS Engineers shall receive nominally 24 hours of continuing training/professional development in a two year period. Up to 12 hours of carryover from a prior two year period is allowed. Acceptable continuing training/professional development activities include presentations at related technical or professional meetings (e.g., ANS National or topical meetings); involvement in ANS standards committees; seminars, workshops, etc.

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10. All personnel required to have UCOR NCS Fundamentals, UCOR NCS for Supervisors, or UCOR NCS for Support Personnel, as identified in 3) through 7) above, shall obtain the training from a contractor-approved supplier. Satisfactory completion of the NCS training will be noted by an “NCS” designator on an access card which is necessary for unescorted entry into a fissile material operation (FMO) area with non-exempt levels of fissile/fissionable material (i.e., governed by a NCSD or NCSE).

11. All personnel performing fissile material handling FMOs where an NCSE determines that there is a credible risk of criticality and CAAS coverage is required, shall obtain a DOE fissile material handler certification per DOE O 426.2, Chg. 1, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*. Justification may be provided, in writing, by UCOR NCS to exempt personnel or FMOs from this requirement or UCOR NCS may evaluate the FMO and develop an FMO-specific fissile material handler qualification card that can be utilized as an equivalent to the DOE certification. If an equivalent UCOR fissile material handler qualification card is utilized, the qualification card shall be incorporated into UCOR-4113, *UCOR LLC Nuclear and Radiological Facilities Qualification Standard, Oak Ridge, Tennessee*.

2.0 NCSE/NCSD Briefing Development Guidance

NCS Engineers shall assist in the development and delivery of NCSE Training and training for selected NCSDs, as appropriate. The briefings shall encompass the controls, initial conditions, assumptions, and operational limitations established in the NCSE or NCSD and procedural flowdown of those controls may be included. NCS Training at a minimum shall contain, as appropriate:

- Terminal Objective
- Enabling Objectives
- Description of Fissile Material Operation
- Basis for Nuclear Criticality Safety
- Upset Conditions Considered
- Passive Design Features
- Active Engineered Features
(for facilities which use active engineered features)
- Administrative Controls
- Selected Controls with the Associated Procedure Flowdown
- Administrative Aids
- Postings

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Attachment C
Standard NCS Signs and Postings
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NCS signs, postings and labels are administrative supplements designed to notify personnel of the presence of fissile material or an anomalous condition, and remind fissile material workers of NCS limits and controls. These administrative aids supplement written procedures; however, the signs, postings and labels **DO NOT** take the place of written procedures and/or work packages.

In the discussion below, the following terms are used:

NCS Sign – indicates the presence of fissile material, summarizes key nuclear criticality safety requirements, designates fissile material work and storage areas, or provides instruction or warning to personnel.

NCS Posting – summarizes key nuclear criticality safety requirements and limits from an NCS Evaluation. Also used to communicate restrictions or limitations on discovery of an anomalous condition.

NCS Labels – positively identifies the information necessary to determine the NCS basis (i.e., NCS Exempt, FSE, greater than FSE, or NCSE specified label) of the fissile material in a container or item. However, it is not a general requirement for the NCS label to identify the specific NCSE/D number.

The following guidance and requirements of this procedure must be followed. However, in cases where the most logical place to provide the NCS controls is on a tool, piece of equipment, or container such that the requirements of this procedure cannot be met, the term “label” can be used in lieu of “posting.” Other requirements that can be met such as font size, type face, etc., should be captured to the extent possible. Use of “labels” should be noted on the NCS implementation form. Labels must not be used for expediency or to avoid meeting the requirements of this procedure. The NCS Manager or designee must approve (e.g., through the NCS implementation form) the use of labels for specific FMOs where the requirements of this procedure cannot be reasonably met.

General Fabrication

1. Shall be of such a material that can survive in the environment in which they are located, and under any other abnormal operating conditions they may be expected to encounter. Laminated paper may be used for permanent indoor or temporary outdoor signs and postings. Sturdy plastic is acceptable material for outdoor signs and postings.
2. Should be black letters on a yellow background, except for “Caution” at the top of the posting and the use of the term “Fissile” around the trefoil. These “Caution” and “Fissile” statements are yellow on black. (See the examples attached.) Other colors may be utilized as appropriate for human factors aspects.
3. NCS signs and postings should be nominally 11 in. in one dimension and 17 in. in the other dimension regardless of the orientation (i.e., “Portrait” or “Landscape”). NCS Anomalous Condition Postings may be of a smaller size, but shall still remain legible.

General Location

1. Shall be located in such a manner that they can easily be seen.
2. Should be positioned separately to avoid conflict or confusion with other radiological and safety signs.

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3. Shall be visible under all expected viewing conditions and should be located where it is expected that most people will be looking (e.g., postings shall not be placed at right angles to the expected normal viewing direction).
4. Shall be placed in close proximity to the associated fissile material operation and should be located where they can be seen during the associated fissile material operation. The postings shall be placed at eye level if practical.
5. Should not be placed where they may be hidden behind a post, an operator control, or where they will become inadvertently covered if someone places an object in front of the hazard site.
6. Should be positively fastened to the equipment or area being controlled so that they will withstand the normal day-to-day operations. May be temporarily relocated in support of operations activities provided they are returned to their designed locations in a timely manner.
7. FCA signs shall be placed to signify the presence of non-exempt quantities of fissile material (i.e., areas covered by NCSEs/NCSDs).

General Lettering

1. In general, the larger the letters and numbers, the better they are seen and recognized. Letters and numbers should be at least 0.3 in. tall.
2. Shall be made legible by selecting the proper letter style and size and by making the contrast between the letters and the background sufficient for whatever lighting condition that may exist.
3. Simple block style fonts should be used. Some of the standard type styles that **are acceptable** include: Arial, Universal, Helvetica, Chicago, and Engravers Gothic BT.
4. Type faces that should be avoided are those which have uneven stroke widths; have extended serifs; are italicized; are stenciled; appear like handwritten script; are shadowed or made to look three-dimensional; or are distorted to look tall and narrow or short and wide. Examples of font styles that **should be avoided** include; Times, Courier, New York, and Bookman.
5. Bold characters may be used for emphasis, but should not be wider than they are tall since such distortion tends to increase recognition time.
6. When horizontal space is limited, narrower characters may be used. In some cases, this is even more desirable than trying to crowd the “optimum” character into a limited space or reducing the space between words. However, avoid selecting extremely narrow characters since they tend to appear blurred and to increase both observation time and errors. An acceptable narrow font style is Letter Gothic Regular.
7. Capital letters should be used for short instructions because they can be read at a greater distance than capital and lowercase letters. Capital and lowercase letters should only be used for extended sentence messages and only when such extended sentences are absolutely necessary.

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General Wording

1. NCSE postings shall communicate the intent of the NCSE requirements, but the wording is NOT required to match wording in the NCSE verbatim.
2. Use as few words as possible within the limits of clarity; i.e., avoid long, complex advisory information or instructions that take too much time to read. Tell the operator exactly what to do or not to do. A verb active or command structure is recommended, e.g., maintain at least 2 ft spacing between all components.
3. Use common terms that originate from typical language usage.
4. Use whole words rather than abbreviations wherever space permits. If abbreviations are required, use commonly accepted abbreviations. Examples of acceptable abbreviations are max, min, and measurement units.
5. Acronyms may be used sparingly if they have been well established over a long period of time and have a standardized and unique meaning for the users.
6. Asterisks, bullets, or numbers should be used to separate the individual cautions; however, the use of Roman numerals as separative items should be avoided since they tend to increase recognition time.
7. Spelled-out numbers should be used when a single digit number can be confused with a letter (i.e., 1 and the letter l) or would tend to be obscured by the other information contained on the posting. When spelled-out numbers are used, the digital number should follow in parenthesis. Numbers should be spelled out when referring to a number of objects, but not spelled out when referring to a unit of measure such as weight, concentration, or distance.

General Limits and Controls

1. Shall be reviewed with facility personnel to ensure the content of the posting is understandable and that appropriate information is included.
2. If the NCSE contains a large number of controls, then only those limits and controls that apply to the operator or those which the operator could affect should be listed.
3. If two limits are stated and either limit constitutes acceptable action, the conditional term OR in underlined capital letters, should be placed between the two limits. A new line should be established when presenting the second item.
4. Shall state limits for operationally-controlled parameters and not engineering parameters that are being controlled (e.g., the size or number of specific-size cans should be stated as a useful limit for the operator, instead of a mass limit, which the operator does not directly control).
5. When special precautionary words or actions are required, select ones that provide a sense of urgency or hazard, and ones which are specific. Avoid words that seem to leave it up to the operator to decide how to comply (e.g., “as required,” “as needed,” “periodically,” or “all approved containers”).

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6. Should not list requirements that the operator does not directly influence or that would be more appropriately addressed by another program such as configuration management, maintenance, or procedure program (e.g., typically, spacing between permanent fixed equipment need not be specified; however, administratively controlled spacing should always be specified).
7. “OK” may be used for clarification if a control statement appears to be an exception or a special case of another control statement.

Other Guidance

1. Anomalous condition postings shall include contact information (who and how to) regarding the anomalous condition.
2. Example signs and postings for Fissile Control Area, NCSE Requirements, , and NCS Anomalous Condition are attached. These signs and postings shall be adhered to unless an alternative is approved by the NCS Manager (see subsection D in “What To Do”). Additional site requirements may be added to the postings when approved by the NCS Manager.
3. The NCSE number should be placed on the posting.
4. The NCS Anomalous Condition postings are used to identify possible NCS deficiencies or infractions and to relay special instructions pertaining to the deficiency or infraction. The ACR posting is to be used to mark the area involved in the ACR.
5. If the NCS Anomalous Condition involves a specific container, identify the container number on the posting, unless the container is isolated and easily identifiable as the subject of the ACR.
6. Postings shall be tracked and should be uniquely numbered (e.g., operator aid logs).

NCS Labels

Labeling is the placement of clear and positive identifying markings on specific units or batches of fissile material (containers or packages) to notify worker of the presence of fissile material and/or to prevent their being mistaken for other material.

Additional information may be necessary for other purposes such as nuclear materials management, radiological protection (RP), or transportation. A single label may contain all the required information so long as the separate meanings are not compromised.

NOTE: NCS labels are applied to all radiological material containers.

There are four types of NCS labels:

- Non-fissile – for all containers meeting an NCS exemption or containing no fissile/fissionable isotopes.
- Fissile Storage Exempt – empty, secondary waste or meets criteria presented in NCSD-MS-LFW-0051.
- Fissile Material Content – fissile mass/concentration exceeding Fissile Storage Exempt criteria.
- WIPP Compliant – fissile masses exceeding Fissile Storage Exempt and meet the Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria (WAC).

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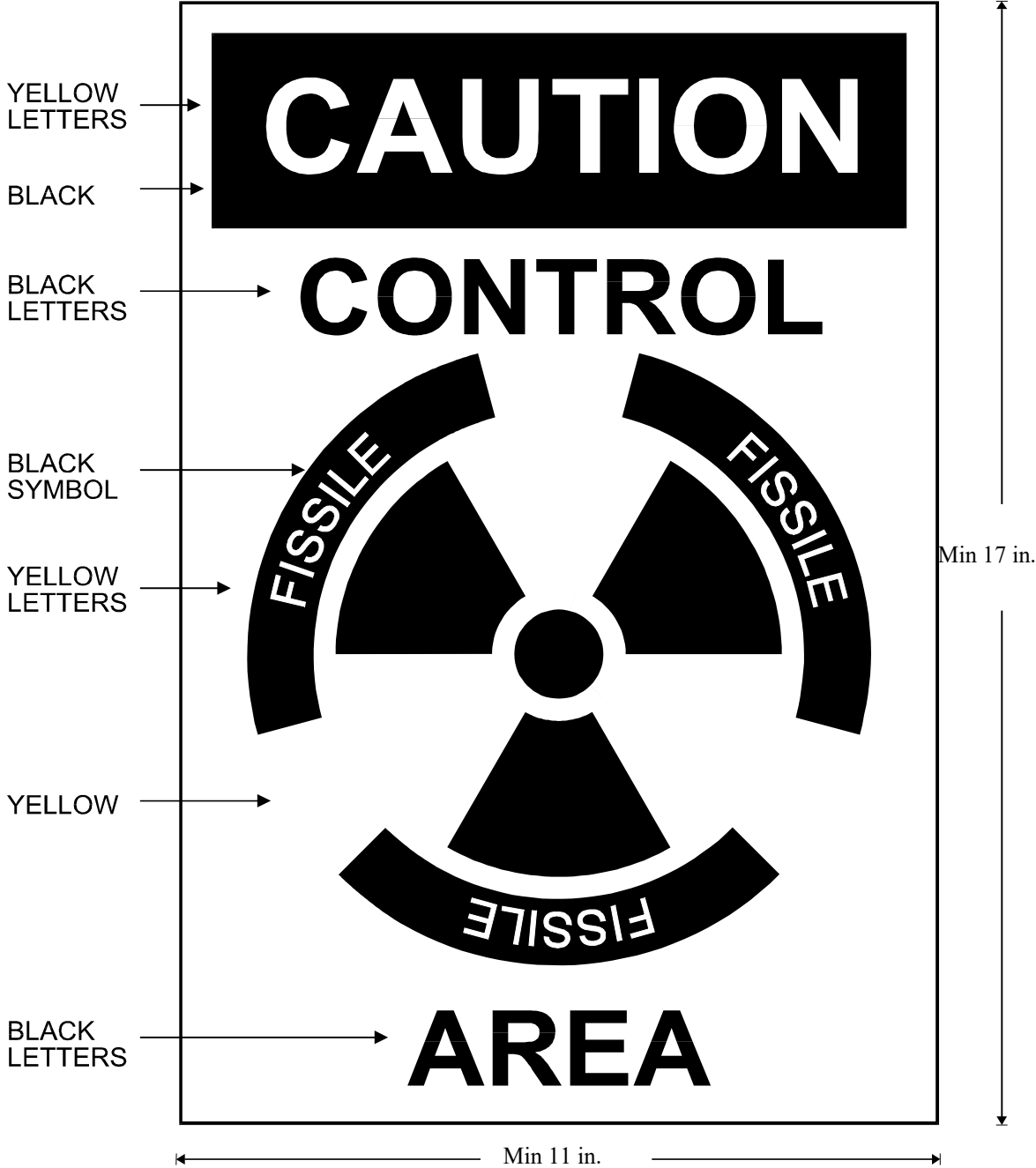
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1. Containers and packages containing radiological material shall be appropriately labeled with one of the labels identified above.
2. Labels shall clearly show all information necessary to ensure identification of fissile materials or identification of the governing NCS basis (i.e., NCS exemption, NCSD or NCSE), but does not need to include the NCS basis document number.

NOTE: Labels used to indicate that containers have been emptied as much as practicable of their fissile material contents shall prominently display the word “empty” unless the old material label is removed, covered, or obliterated, or unless the absence of fissile material is readily apparent. A single prominently displayed sign may be used in place of individual labels for groups of empty containers.

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EXAMPLE FCA SIGN



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Standard NCS Signs and Postings
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EXAMPLE NCS REQUIREMENTS POSTING

(Note that in some cases, the NCSE revision number may not be included.)

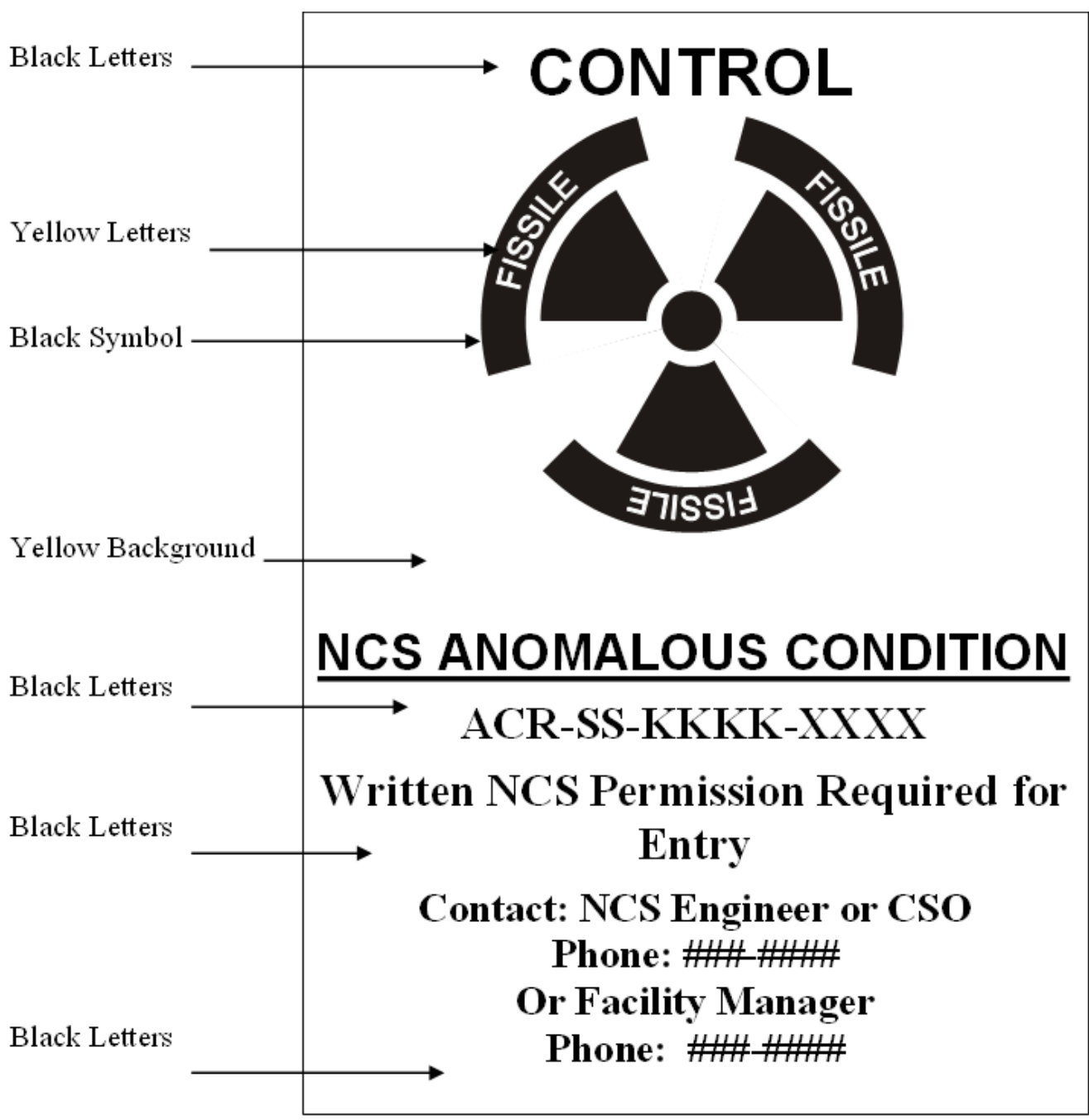
The diagram shows a rectangular sign with a black border. The sign is divided into several horizontal sections. At the top is a black rectangular box containing the word "CAUTION" in large, white, bold, sans-serif capital letters. Below this is a radiation warning symbol consisting of a central black circle with three black blades extending outwards, all on a white background. The word "FISSILE" is written in black, sans-serif capital letters along the outer edge of each blade. Below the symbol is the text "NCS REQUIREMENTS" in large, black, bold, sans-serif capital letters. Underneath this text are five horizontal lines representing a ticket molding area. At the bottom of the sign, there are two lines of text: "Contact: 555-5555" on the left and "NCSE-SS-KKKK-XXXX, Rev. Z" on the right.

Callouts on the left side of the sign indicate the following specifications:

- YELLOW LETTERS**: Points to the "CAUTION" text.
- BLACK**: Points to the background of the "CAUTION" box.
- BLACK SYMBOL**: Points to the radiation warning symbol.
- YELLOW LETTERS**: Points to the "FISSILE" text on the symbol.
- YELLOW**: Points to the background of the sign.
- BLACK LETTERS**: Points to the "NCS REQUIREMENTS" text.
- TICKET MOLDING (BLACK)**: Points to the horizontal lines below the "NCS REQUIREMENTS" text.

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EXAMPLE NCS ANOMALOUS CONDITION POSTING



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Attachment D
Verification Checklist for NCS Implementation
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The Nuclear Criticality Verification Checklist (NCVC, Form-3563), consisting of an Implementation Approval Checklist for NCS and an Implementing Action for NCS Checklist, is located on the UCOR forms website under the Forms Library. The checklist may be altered as desired, but the information on the most current version of the checklist at the above specified location shall be included as a minimum.

The implementation verification checklist should be filled out for each location where the FMO will be conducted. However, if the operation is not location specific (e.g., site-wide NCSE/NCSD), the implementation is only required to be applied to the FMO process upon initial implementation of the FMO. For these cases, the “location” block on the implementation verification checklist should identify the entire site as the location. If the FMO is a storage operation, the implementation verification checklist may identify a process for creating future storage locations so the implementation verification checklist is only required for initial NCS implementation.

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Attachment E
NCS Surveillance Report
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Guidelines for Performing an NCS Surveillance

The following are guidelines for performing a NCS Surveillance. The NCS Surveillance Report form, Form-3564, can be located on the UCOR forms homepage.

1. Items to observe during NCS surveillance of the operations include but are not limited to the following:
 - Differences between the actual operation and the FMO description in the NCSE or NCSD.
 - Correct use of operating procedures and checklists.
 - NCSE specific postings for proper placement and correct wording.
 - Container spacing and stacking requirements.
 - Barriers and other administrative aids.
 - Adequacy of the receipt inspection procedure or program for NCS Design Feature items.

2. The NCS surveillance should be used to inspect NCS items credited as Design Features in safety basis documents. These may include such items as material containers, material storage cabinets, storage racks, and safe vacuums. Features to be inspected initially (may be covered by receipt inspection procedure or program) include such items as container size, volume, and dimensions; storage cabinet spacing and configuration; safe vacuum dimensions; and/or other physical characteristics required for the Design Features to meet their intended safety function. Subsequent inspections should address potential damage and degradation of items.

3. The NCS surveillance should include an overall perspective of the FMO to identify changes in the actual operation from the description in the NCSE or NCSD, to determine if NCS requirements are being followed as defined in the NCSE, and to identify new NCS hazards for either the NCSE or NCSD.

4. Engineering judgment should be used in the performance of the NCS surveillance. It is often unnecessary to perform a 100% surveillance of the operations covered by an NCSE or NCSD or inspections of NCS items identified as Design Features. Examples of when surveillance/inspection of less than 100% of the operations or Design Features would be acceptable include but are not limited to the following:
 - The review of facility fissile material inventory documentation.
 - Multiple containers or storage arrays under the same NCS administrative limits and controls.
 - Equipment dimensions or other parameters controlled by a formal configuration control system.
 - Items credited as Design Features are controlled under procedures or programs for procurement, receipt inspection, labeling, controlled storage, and issue for use.

5. The FMO should be discussed with the operations supervisors and staff to determine and reinforce their understanding of the NCS limits and controls, to obtain feedback on possible improvements to the NCSE, and to address any NCS concerns.

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6. Operating procedures and checklists should be reviewed for correct flow down of the NCS Administrative Limits and Controls from the NCSE.
7. The documentation of the fissile material stored within each facility governed by the NCSE or NCSD should be reviewed. The fissile material documentation shall be readily available for review and meet the requirements of the associated NCSE or matches the description within the NCSD.
8. The NCSE should be evaluated as to whether the operations could be performed under an NCSD or the use of FMCL, if applicable.

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Attachment F
NCS Criteria and Policies
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The criteria and policies shown below are fundamental bases for the conduct of NCS at UCOR facilities. The Criticality Safety Review Committee (CSRC) may make recommendations to senior management for proposed deviations from these criteria and policies. Changes to these fundamentals may occur through review by the CSRC, which may make recommendations to management.

1. Fissile material operations will be evaluated using the double contingency principle or justifying that criticality is not credible.
2. Limits for nuclear criticality safety shall be established on bases derived from experiments. In the absence of directly applicable experimental measurements, the limits may be derived from calculations made by a method shown to be valid by comparison with experimental data, provided allowances are made for uncertainties in the data and in the calculations.
3. The possibility of malicious or intentional damage should not be considered in establishing the limits and conditions necessary for safe nuclear operation.
4. Where practical, primary reliance shall be placed on passive design features rather than on administrative controls.
5. Where possible, operations with fissile material of different isotopic enrichment shall be physically segregated. In areas where materials of more than one isotopic enrichment must be handled, the limits and conditions necessary for safe nuclear operation shall be based upon credible bounding enrichments that may be encountered. Note that for some systems where moderation is restricted due to field conditions or controls, lower enrichments may result in higher neutron multiplication factors and thus be bounding of higher enrichments.
6. For fissile control areas where uranium solutions of more than one concentration may be handled, the process and storage equipment shall be evaluated to be of safe geometry for the most reactive concentration available.
7. Hydrogen, as found in ordinary water, is normally considered the most prevalent and significant of the moderators and reflectors available. Specific situations may require consideration of other reflecting or moderating materials (e.g., hydrocarbon oils, polyethylene, beryllium, etc).
8. Any single batch of fissile material (loaded container) must be subcritical if fully reflected by water.
9. As a minimum, two batches together must be subcritical under the neutron reflection conditions normally encountered for the specific situation being evaluated (i.e., nominal reflection).
10. For operations depending upon mass control, the possibility of excessive mass shall be considered in evaluations when the contained volume does not automatically limit the contents to a subcritical mass (350 g ²³⁵U FEM or 250 g ²³⁵U FEM if supermoderators are present) or less. Also, if the potential for fissile accumulation as holdup exists for an operation, it shall be addressed.

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NCS Criteria and Policies
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11. Intermixed neutron absorber (e.g., cadmium, boron, or gadolinium) may be used for primary NCS control only after all other practicable means have been considered. Moreover, when such absorbers are used, the administrative controls must be sufficiently strong to ensure the continuing presence and condition of the absorbers. The use of neutron absorbers for criticality safety control requires the review and concurrence of the CSRC.

12. Credible intrusion and accumulation of water from various sources such as sprinklers, fire fighting, roof leaks, broken pipes, failed valves, etc., shall be included in the evaluation of fissile material activities (receipt, possession, storage, processing, or transport). Areas in which special controls on moderators are necessary, designated as Moderator Control Areas, shall be identified to personnel in accordance with facility-specific procedures and included in pre-fire plans.

13. If an NCSE does not document either that a criticality is not credible, or that the FMO satisfies the double contingency principle, the evaluated FMO must be reviewed and approved by DOE Oak Ridge Office of Environmental Management (OREM). DOE OREM approval shall be obtained either by (1) submittal to DOE OREM of a NCS document that summarizes the FMO and the justification for deviating from the double contingency principle, or (2) through the safety basis process, i.e., revision to and approval of the subject facility DSA/TSR. The approval must be documented prior to implementation/use of the NCSE.

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Attachment G
NCS Program Implementation
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This attachment illustrates how various subcontractors implement the UCOR NCSP based upon their scope of work. This attachment is only an illustration and is not intended to override any requirements contained in the main body of this or any other UCOR procedure. Also, this attachment is not intended to provide any additional requirements to those identified in the main body of this procedure.

Company Scope of Work	NCSP Actions
Perform non-fissile work in FMO areas with non-exempt levels of fissile materials (i.e., governed by an NCSD or NCSE).	Ensure employees have Parkworker Training (PWT).
	Ensure employees requiring unescorted access to fissile control area (FCA) posted areas have NCS for Support Personnel training or approved equivalent.
Perform FMO work (e.g., handle fissile material/container, perform maintenance on a system containing fissile material).	Ensure employees have PWT.
	Ensure employees have NCSD and/or NCSE specific training and NCS fundamentals training appropriate to their job responsibilities (NCS Fundamentals Training or NCS Fundamentals Training for Managers/Supervisors).
	Ensure employees perform responsibilities, as appropriate, for positions prescribed responsibilities for work steps in the “What To Do” section of this procedure.
Provide NCS Engineer support.	Ensure employees have PWT.
	Ensure that NCS Engineers meet the qualifications of UCOR-4113, or have an approved exemption, before performing unassisted NCS Engineer functions.
	Ensure employees perform responsibilities for NCS Engineers.
	Ensure appropriate metrics data are provided to the NCS Manager.
Provide CSO support (if applicable).	Ensure employees have PWT.
	Ensure that CSOs meet the qualifications of UCOR-4113, or have an approved exemption, before performing unassisted CSO functions.
	Ensure employees perform responsibilities for CSOs.
NOTE:	To ensure employees are properly trained, management must monitor employee training status. Employees without required training or timely refresher training must not be allowed to perform work in areas where that training is required.

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Attachment H
NCS Program Exemption
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For material considered NCS Exempt, the fissile material involved must meet one of the following exemption criteria and shall not be staged or stored in the same area with other fissile material governed by an NCSE or NCSD without specific NCSO approval.

The application of the following NCS exempt criteria requires NCS review to ensure that no credible upset condition could challenge the exemption status.

NOTE 1: ²³⁵U FEM factors and FMCL values in Table 1 have been updated to incorporate ANSI/ANS-8.15-2014. It is recognized that documents and processes in place prior to revision 6 of this procedure are being updated but may contain descriptions and/or conclusions for NCS and fissile material inventory based on previous FMCL or FEM values. See UCOR-4172, Rev. 4, Attachment A for more information.

NOTE 2: NCS Exempt materials do not require a NCSD or NCSE, but are still subject to applicable requirements in the NCS Program (e.g., UCD discovery and ACR process). For complicated systems or operations incorporating multiple exemptions at once, an NCEX is suggested to ensure proper documentation and understanding of the exemption status and limitations.

a. Mass Exemption:

If the total inventory of a facility can be shown to be less than 350 grams ²³⁵U FEM (see Table 1) or 250 grams ²³⁵U FEM if significant quantities of supermoderators (see definition in Attachment A) are present and said facility does not have interaction capabilities with other fissile material operations, then the facility does not require an NCSE or NCSD.

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NCS Program Exemption
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Table 1 - Fissionable Material Control Limits (FMCL) ^{a, b}

Nuclide	FMCL (grams)	f_{35} (mass factor for ²³⁵ U FEM)
²³² U	320	0.78
²³³ U	170	1.4
²³⁴ U	12000	0.021
²³⁵ U	350 / 250 ^c	1.0
²³⁷ Np	7500	0.033
²³⁶ Pu	160	1.56
²³⁸ Pu	1100	0.21
²³⁹ Pu	160	1.56
²⁴⁰ Pu	5300	0.047
²⁴¹ Pu	50	5
²⁴² Pu	14000	0.018
²⁴¹ Am	5700	0.044
^{242m} Am	3.2	78
²⁴³ Am	16000	0.016
²⁴² Cm	1400	0.18
²⁴³ Cm	28	8.8
²⁴⁴ Cm	2500	0.1
²⁴⁵ Cm	7.8	32
²⁴⁶ Cm	3500	0.07
²⁴⁷ Cm	120	2
²⁴⁹ Cf	3.5	70
²⁵¹ Cf	1.7	140

^a Based on single-parameter limits for isolated aqueous mixtures, *American National Standard for Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*, ANSI/ANS-8.1-2014. American Nuclear Society, La Grange Park, Illinois.

^b Based on single-parameter limits for isolated aqueous mixtures, *American National Standard for Nuclear Criticality Control of Special Actinide Elements*, ANSI/ANS-8.15-2014. American Nuclear Society, La Grange Park, Illinois.

^c The FMCL for ²³⁵U for cases with supermoderator is 250 grams. For all other cases the limit is 350 grams.

b. Mass/Volume Exemption:

Movement and storage of closed packages or containers with an individual volume greater than 10 liters and each containing less than 15 grams ²³⁵U FEM¹ does not require an NCSE or NCSD.

c. De Minimis Quantity Exemption²:

Items (e.g., a container or piece of equipment) containing 2.0 grams ²³⁵U FEM or less do not require an NCSE or NCSD.

¹ NCSD-SM-01-0011, *Fissionable Exempt Material Determination*.

² NCSR-MS-DEMIN-0064, *Deminimus Threshold for Fissionable Materials*.

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d. Enrichment Exemption:

Depleted and natural uranium in any amount (except as reflectors) and fissile material at the following enrichments³

U metal	≤ 0.93%
U compounds	≤ 0.96%
Uranyl Nitrate	≤ 1.96%

in the absence of significant quantities of supermoderators (see definition of supermoderation in Attachment A) do not require an NCSE or NCSD.

e. Concentration Exemption:

If contaminated material can be shown to have a ²³⁵U or ²³³U concentration that is less than 0.002 grams ²³⁵U FEM per gram of material⁴, and the fissile material is uniformly distributed across the material and does not contain concentrated deposits of fissile material, then the packaging, storage, handling, transportation, and burial of this material does not require an NCSE or NCSD.

If contaminated material can be shown to have a ²³⁹Pu concentration that is less than 0.001 grams ²³⁵U FEM per gram of material⁵, and the fissile material is uniformly distributed across the material and does not contain concentrated deposits of fissile material, then the packaging, storage, handling, transportation, and burial of this material does not require an NCSE or NCSD.

NOTE 1: ²³⁵U FEM factors are calculated using the FMCL values for each fissionable isotope listed in Table 1. The FMCL values are calculated from the ANSI/ANS-8.1 and ANSI/ANS-8.15 published subcritical mass limits. These subcritical mass limits are determined considering single units reflected by water or steel. The neutronics of large, relatively homogeneous volumes of soil, building debris or waste may result in configurations not bound by those single, reflected units. Concentration exemption values are provided, and are proven to be acceptable for ²³³U, ²³⁵U and ²³⁹Pu, specifically. The use of ²³⁵U FEM in calculations of fissionable material concentration when the primary fissionable material isotope is not ²³³U, ²³⁵U or ²³⁹Pu should be supported by supplementary detailed physics calculations using approved methods and cross-section data.

NOTE 2: If it is credible to redistribute the fissile material within the material and potentially create concentrated deposits, then an NCSE or NCSD is required.

f. Fixed Contamination Exemption:

Areas or equipment with external fixed contamination, covered by the radiological protection program, do not require an NCSE or NCSD.

³ The values come directly from ANSI/ANS-8.1.

⁴ NCSE-MS-NTS-1492, *Emplacement of ORR Waste at the Nevada Test Site*.

⁵ NCSD-YT-EMWMF-0057, *Beryllium Considerations at the EMWMF*.

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g. Removable Contamination Exemption:

Buildings, facilities, and demolition equipment with no hidden inaccessible surface areas with removable contamination below Radiation Protection posting limits less than 1000 dpm/100 cm² do not require an NCSE or NCSD.