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Nuclear fuel technology — Administrative criteria related to nuclear criticality safety

Technologie du combustible nucléaire — Critères administratifs concernant la sûreté-criticité nucléaire

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

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Introduction

An effective nuclear criticality-safety programme includes cooperation among management, supervision, and the nuclear criticality-safety staff and, for each employee, relies upon conformance with operating procedures. Although the extent and complexity of safety-related activities may vary greatly with the size and type of operation with fissile material, certain safety elements are common. This International Standard represents a codification of such elements related to nuclear criticality safety. General guidance for nuclear criticality safety may be found in ISO 1709.

Nuclear fuel technology — Administrative criteria related to nuclear criticality safety

1 Scope

This International Standard provides criteria for the administration of nuclear criticality-safety-related activities for operations which take place outside of reactors and for which there exists a potential for criticality accidents.

The responsibilities of management, supervision, and the nuclear criticality-safety staff are addressed. The Objectives and characteristics of operating and emergency procedures are included in this International Standard.

2 Responsibilities

2.1 Management

Management shall formulate a nuclear criticality-safety policy and make it known to all employees involved in operations with fissile material.

Management shall accept overall responsibility for nuclear criticality safety of operations.

Management shall assign responsibility and delegate commensurate authority to implement the established policy. Responsibility for nuclear criticality safety should be assigned in a manner that is no less rigorous than for other safety disciplines.

Management shall provide nuclear criticality-safety staff, familiar with the physics of nuclear criticality and with associated safety practices, to furnish technical guidance appropriate to the scope of operations. This function should, to the extent practicable, be administratively independent of operations.

Management shall establish a means for monitoring the nuclear criticality-safety programme.

Management shall establish a defined process and an equipment change control procedure.

Management shall be involved in periodic reviews of their nuclear criticality-safety programme effectiveness.

Management shall establish operation procedures and their modification.

2.2 Operations supervisors

Each supervisor shall accept responsibility for the safety of operations under his/her control.

Each supervisor shall be aware of the controlled parameters and associated limits relevant to operations under his/her control. Additionally, they shall have a working knowledge of relevant basic criticality methods of control (e.g. mass, concentration, shape, etc.). Training and assistance with regard to these basic criticality methods of control should be obtained from the nuclear criticality-safety staff.

Each supervisor shall provide training and shall require that the personnel under his/her supervision have an understanding of procedures and safety considerations such that they may be expected to perform their functions without undue risk. Records of training activities and verification of personnel understanding should be maintained.

Each supervisor shall develop, or participate in the development of, written procedures applicable to the operations under their control. Maintenance of these procedures to reflect changes in operations shall be a continuing supervisory responsibility.

Each supervisor, with the help of the nuclear criticality-safety staff as needed, shall verify compliance with nuclear criticality-safety specifications for new or modified processes or equipment before their application. Verification may be based on inspection reports or other features of the quality-control system.

Each supervisor shall require conformance with good safety practices, including unambiguous identification of fissile materials and good housekeeping.

2.3 Nuclear criticality-safety staff

The nuclear criticality-safety staff shall provide and accept responsibility for documented nuclear criticaity-safety guidance for the design of equipment and processes and for the development of operating procedures.

The staff shall maintain familiarity with current developments in nuclear criticality-safety standards and guides. Knowledge of current nuclear criticality information and computational codes should be maintained.

The staff should consult knowledgeable individuals to obtain technical assistance as needed.

The staff shall maintain familiarity with all fissionable material operations within their area of responsiblity for nuclear criticality safety.

The staff shall assist supervision, on request, in training personnel.

The staff shall conduct, or participate in, audits of nuclear criticality-safety practices and compliance with procedures as directed by management.

The staff, with supervision, shall conduct or participate in the investigation of procedural violations and other deficiencies for possible improvement of safety practices and procedural requirements as directed by management.

The nuclear criticality-safety staff shall, upon request, participate in the verification of compliance with nuclear criticality-safety specifications for intended new or modified processes or equipment.

3 Operating procedures

The purpose of written operating procedures is to facilitate and to document the safe and efficient conduct of the operations. Procedures should be organized for convenient use by operators and be conveniently available. They should be free of extraneous information not relevant to safe and efficient conduct of the operation.

Procedures shall include those controls and limits that are significant to the nuclear criticality safety of the operation and identify them as such.

Supplementing and revising procedures, as improvements become desirable, shall be facilitated.

Currently used procedures shall be reviewed periodically by supervision.

Intended new or revised procedures impacting nuclear criticality safety shall be reviewed by the nuclear criticality-safety staff and supervision and shall be approved by management.

Procedures should be supplemented by posted nuclear criticality-safety limits or limits incorporated in operating check lists, flow sheets, or automated control systems.

Deviations from operating procedures and unforeseen alterations in process conditions that affect nuclear criticality safety shall be reported to supervision and management, investigated promptly, corrected as appropriate, and documented. Action shall be taken to prevent a recurrence.

Operations shall be reviewed frequently (at least annually) to ascertain that procedures are being followed and that process conditions have not been altered so as to affect the nuclear criticality-safety evaluation.

4 Process evaluation for nuclear criticality safety

Before starting a new operation with fissile material or before an existing operation is changed, it shall be determined and documented that the entire process will be subcritical under both normal and credible abnormal conditions.

The nuclear criticality-safety evaluation shall determine and explicitly identify the controlled parameters and their associated limits upon which nuclear criticality safety depends. The effect of changes in these parameters, or in the conditions to which they apply, shall be evaluated and documented.

The nuclear criticality-safety evaluation shall be documented with sufficient detail, clarity, and lack of ambiguity to allow an independent judgment of results.

All equipment, procedures, data and methods of evaluation which are important to a nuclear criticality-safety evaluation shall be valid for their stated purpose.

Before starting a new operation with fissile material or before an existing operation is changed, there shall be an independent review that confirms the adequacy of the nuclear criticality-safety evaluation.

5 Materials control

The movement of fissile materials shall be controlled as specified in approved procedures. The transport of fissile materials within the public domain shall comply with appropriate national and international regulations.

Appropriate material identification shall be maintained.

Personnel access to areas where fissile material is handled, processed, or stored shall be controlled.

Control of spacing, mass, density and geometry of fissile material shall be maintained to assure subcriticality under all normal and credible abnormal conditions as stated in the nuclear criticality-safety evaluation documentation.

Appropriate arrangements shall be made between the consignor and consignee before fissile material is dispatched from an establishment. Any discrepancies observed upon receipt shall be resolved. Provision shall be made for the receipt of damaged packages.

6 Planned response to nuclear criticality accidents

Guidance for use of nuclear criticality accident alarm systems and equipment design may be obtained from ISO 7753 and IEC 60860.

Emergency procedures shall be prepared and approved by management. Organizations, on- and off-site, that are expected to provide assistance during emergencies shall be informed of conditions that might be encountered. These organizations should be assisted by facility staff in preparing suitable emergency-response procedures.

Emergency procedures shall clearly designate evacuation routes. Evacuation should follow the quickest and most direct routes practicable, with consideration for reducing radiation exposure. These routes shall be clearly identified and should avoid recognized areas of higher risk.

Personnel assembly locations, outside the areas to be evacuated, shall be designated with consideration for potential radiation exposure. Means to account for personnel shall be established.

Personnel in the area to be evacuated shall be trained in evacuation methods and informed of evacuation routes and assembly locations. Provision shall be made for the evacuation of transient personnel. Safety drills shall be performed periodically to maintain familiarity with the emergency procedures. To avoid disorder, safety drills should be announced in advance.

Arrangements shall be made in advance for the care and treatment of injured and exposed persons. The possibility of personnel contamination by radioactive materials shall be considered.

Planning shall include a programme for the prompt identification of exposed individuals and should include personnel dosimetry.

Instrumentation and procedures shall be provided for determining the radiation intensity at assembly locations.

Planning and arrangements should provide for a central control point for correlating information useful for emergency response.

Emergency procedures shall address re-entry procedures and the membership of response teams. Lines of authority and communication shall be included.

Bibliography

[1] ISO 1709:1995, *Nuclear energy — Fissile materials — Principles of criticality safety in storing, handling and processing*

[2] ISO 7753:1987, *Nuclear energy — Performance and testing requirements for criticality detection and alarm systems*

[3] IEC 60860:1987, *Warning equipment for criticality accidents*