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Nuclear criticality safety — Use of criticality accident alarm systems for operations

*Sûreté-criticité — Systèmes de détection et d'alarme de criticité dans
le cadre de l'exploitation*



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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 85 *Nuclear energy, nuclear technologies, and radiological protection*, Subcommittee SC 5 *Nuclear installations, processes and technologies*.

This second edition cancels and replaces the first edition (ISO 7753:1987), which has been technically revised.

The main changes are as follows:

- clarification of the scope and title: this standard is intended for CAAS users;
- improved differentiation with IEC 60860, intended for CAAS designers, manufacturers, providers...;
- removal of CAAS need considerations from the normative part;
- more open definition of the MAC to reflect the variety of practices and possibilities;
- more developed clauses regarding management of unavailability, reliability, positioning of CAAS components;
- addition of a “continuum of detection” concept;
- better integration with other existing ISO standards related to criticality-safety (ISO 1709, ISO 11320, ISO 27467, ISO 14943, ISO 16117 and ISO 21391);
- rewriting and expansion of informative [Annexes A](#) and [B](#):
 - Elements for the definition of the minimum accident of concern;
 - Principles for CAAS detectors positioning;
- creation of an informative [Annex C](#): Examples of CAAS need considerations.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Nuclear criticality safety programs at facilities that might use or store significant quantities and concentrations of fissile material are primarily directed at avoiding nuclear criticality accidents. However, the possibility of such accidents exists and the consequences can be life-threatening. Nuclear criticality accidents are complex events that can take various forms and without warning signs. For facilities that are judged to have potential for a nuclear criticality accident, the defense-in-depth principle requires limiting their radiological consequences.

Criticality accident alarm systems (CAAS) provide a means to detect nuclear criticality accidents and to trigger an alarm to prompt the evacuation to a radiologically safe location.

This detection is very specific because of the various possible neutron kinetics and radiation fields produced by a nuclear criticality accident comprising neutrons and photons (i.e. gamma radiation) with a broad spectrum of energies. The primary purpose of CAAS is to prompt personnel to evacuate as soon as possible during a nuclear criticality accident, thus limiting individual and collective radiological doses. A CAAS cannot, and is not intended to, protect personnel from radiation from a nuclear criticality accident prior to prompt evacuation or other protective actions.

Considerations about emergency preparedness and response, including the evacuation procedure related to nuclear criticality accidents, are addressed in ISO 11320.

This document is supplemented by three informative annexes:

- [Annex A](#) outlines elements for the definition of the minimum accident of concern (MAC);
- [Annex B](#) provides examples of application of this document for the positioning of CAAS detectors;
- [Annex C](#) looks at the factors which are considered when assessing whether a CAAS is needed or not, through examples.