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Nuclear criticality safety – Nuclear criticality safety training for operations

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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.

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.

ISO-23133 was prepared by Technical Committee ISO/TC 85, *Nuclear Energy*, Subcommittee SC 5, *Nuclear Fuel Technology*.

Introduction

In order to maintain nuclear criticality safety for facilities handling and processing nuclear material it is necessary to ensure the Operations Staff, Operations Supervisors, and Management are suitably trained in nuclear criticality safety. This document was developed in response to demand for a definition of the minimum nuclear criticality safety training requirements for Operations Staff, Operations Supervisors, and Management.

This training is distinct from that of the training necessary for Nuclear Criticality Safety Staff in that it is tailored to suit the needs of maintaining nuclear criticality safety for operations. This document sets out the standards necessary to achieve and maintain an adequate level of understanding and knowledge in order to operate nuclear facilities safely with respect to nuclear criticality safety.

Nuclear criticality safety – Nuclear criticality safety training for operations

1 Scope

This document specifies the minimum nuclear criticality safety training requirements for Operations Staff, Operations Supervisors, and Management. The requirement for the training of Operations Staff, Operations Supervisors and Management is identified in ISO–1709.

This document is applicable to areas, processes or facilities containing quantities of fissile nuclides in which nuclear criticality safety is required to be established, except for nuclear reactors where the core is fully loaded.

This document is not applicable to the transport of fissile materials outside the boundaries of nuclear establishments, nor for the response to a criticality accident. Training for response to a criticality accident is considered in ISO-11320.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1709:2018, *Nuclear energy — Fissile materials — Principles of criticality safety in storing, handling and processing*

ISO 11320:2011, *Nuclear criticality safety — Emergency preparedness and response*

ISO 14943:2014, *Nuclear Fuel Technology — Administrative Criteria Relating to Nuclear Criticality Safety*

3 Terms and definitions

For the purposes of this document, the following apply:

3.1
Operations Staff
Workers who, in the act of carrying out activities as part of a facility or process, have responsibilities for maintaining nuclear criticality safety.

Note 1 to entry: These include staff performing activities in accordance with written procedures as part of production, processing and handling of nuclear materials. They may also include staff such as maintenance engineers, health physics monitors etc. if they could have an effect on nuclear criticality safety either through action or inaction as part of their duties. They do not include support staff, whose actions would not be expected to affect nuclear material processes.

3.2
Operations Supervisor
Individual with direct or indirect responsibility for maintaining nuclear criticality safety day-to-day for any facility or process.

3.3
Management
Individuals with overall responsibility for the nuclear criticality safety of operations for a site, process or facility.

3.4
Nuclear Criticality Safety Staff
Individuals highly competent in nuclear criticality safety.

Note 1 to entry: The staff should, at least, be familiar with the fissionable material operations for which they provide nuclear criticality safety support.

3.5
Trainee
Individual being trained in nuclear criticality safety.

3.6
Criticality Trainer
An individual competent in delivering nuclear criticality safety training materials.

3.7
Training Coordinator
Individual who provides assistance and advice to facilitate nuclear criticality safety training.

3.8
Nuclear Criticality Safety Program
Arrangements and procedures implemented in order to ensure nuclear criticality safety for a site, facility or process.

3.9
Operations Training Program
Program detailing the training requirements, method of delivery, and evaluation process for Operations Staff, Operations Supervisors and Management.

4 Operations Training

4.1 Operations Training Program

The Nuclear Criticality Safety Program shall include an Operations Training Program.

Operations training in nuclear criticality safety is crucial as part of an effective Nuclear Criticality Safety Program. Experience of criticality accidents and evidence of operations history worldwide has indicated that human errors on different levels (Management, Operations Staff, and/or Operations Supervisors), through lack of understanding or ignorance of nuclear criticality safety, has contributed to accidents. Training in nuclear criticality safety will assist in minimising such errors.

4.2 Objectives

A Nuclear Criticality Safety Operations Training Program shall address the following principal objectives:

a) Understanding of the nature of a criticality accident so that the severity of the hazard and the need for maintaining safety are understood;

b) Understanding of the mechanisms and activities to control nuclear criticality safety;

c) Understanding that everyone involved in operations, directly or indirectly, can affect nuclear criticality safety;

d) Understanding of nuclear criticality safety relating to operations in the specific workplace in order to provide direct and relevant nuclear criticality safety training.

Sufficient training shall be provided and confirmed to be effective, in keeping with Sections 6, 7 and 8 of this document, before responsibilities to maintain nuclear criticality safety for any individual are

commenced. The continued effectiveness of the training shall be evaluated or refresher training shall be required as detailed in Section 9 of this document.

4.3 Training of Operations Staff

Training in nuclear criticality safety shall be provided with due consideration of the nature of the work individuals perform and the sensitivity of that work in maintaining nuclear criticality safety in operations.

Operations Staff working according to procedures that are required to maintain nuclear criticality safety will require a greater extent of training than those staff who do not perform those duties or, by the nature of their tasks, are intrinsically less sensitive for maintaining nuclear criticality safety.

EXAMPLE Staff in a facility handling inventories of multiple critical masses, with nuclear criticality safety predicated on administrative control of batch sizes, will typically require a higher level of training than a facility handling typically small fractions of a critical mass.

The scope and the level (depth) of training shall be formulated to enable the Operations Staff to operate a process with sufficient understanding of the criticality hazards associated with that process, and the importance and reasons behind the controls identified to maintain nuclear criticality safety.

Understanding the reasons behind the controls may reduce the risk of Operations Staff deviating from processes and/or responding inappropriately to unexpected process conditions. Analysis of past criticality accidents has revealed a number of instances where inadequate understanding of the reasons behind the criticality controls has led to a criticality hazard.

4.4 Training of Operations Supervisors

Certain roles are particularly important in maintaining nuclear criticality safety. A supervisory role to Operations Staff is one such role, as are those roles responsible for making decisions which could significantly affect nuclear criticality safety (e.g. Operations Manager or Shift Team Leader). These key safety roles are termed collectively in this document as Operations Supervisors (as defined in Section 3.2).

Operations Supervisors shall be subject to more extensive training in order to extend their understanding of nuclear criticality safety. This training should be biased to the particular nuclear criticality safety issues associated with the process for which they have responsibilities, and shall be in addition to the identified training for Operations Staff for that facility.

Operations Supervisors may make strategic decisions with the potential to significantly affect nuclear criticality safety. Therefore, it is necessary to have a more comprehensive understanding of the nuclear criticality safety issues and their significance. This could include understanding of typical or common themes that have caused criticality accidents and the need to maintain systems to monitor, maintain and improve nuclear criticality safety in a facility. The specific content of the required training is discussed in Section 6.

4.5 Training of Management

Management shall have an awareness of the severity of the consequences of nuclear criticality accidents to the immediate persons involved and, hence, the importance of a suitable Nuclear Criticality Safety Program.

Management have overall responsibility for the nuclear criticality safety of operations for a site, process or facility. Management define the nuclear criticality safety program and it is important that they understand the risks associated with a criticality accident. Management do not require detailed criticality training because they do not carry out operations and, therefore, rely on Operations Supervisors, Operations Staff, and Nuclear Criticality Safety Staff to maintain day-to-day criticality safety.