

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Nuclear power plants – Instrumentation and control important to safety –  
Radiation monitoring systems (RMS): Characteristics and lifecycle**

**Centrales nucléaires de puissance – Instrumentation et contrôle-commande  
importants pour la sûreté – Systèmes de surveillance des rayonnements (SSR):  
Caractéristiques et cycle de vie**



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Withdrawn

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**NUCLEAR POWER PLANTS – INSTRUMENTATION  
AND CONTROL IMPORTANT TO SAFETY –  
RADIATION MONITORING SYSTEMS (RMS):  
CHARACTERISTICS AND LIFECYCLE**

FOREWORD

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International Standard IEC 62705 has been prepared by subcommittee 45A: Instrumentation, control and electrical systems of nuclear facilities, of IEC technical committee 45: Nuclear instrumentation.

The text of this standard is based on the following documents:

FDIS	Report on voting
45A/960/FDIS	45A/973/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

Withdrawn

## INTRODUCTION

### a) Technical background, main issues and organisation of the Standard

This IEC standard sets out the requirements for the lifecycle management of radiation monitoring system (RMS) installed in the nuclear power plants (NPPs). This standard is applicable to the equipment of RMS and intended to be used during normal operations and anticipated operational occurrences, as well as, for certain monitors, in accident conditions. This standard may be applicable to other nuclear facilities (e.g. nuclear fuel storage and processing sites) by evaluating the differences from NPPs.

It is intended that the Standard be used by operators of NPPs (utilities), systems evaluators and by licensors.

### b) Situation of the current Standard in the structure of the IEC SC 45A standard series

IEC 62705 is the third level in the hierarchy of SC 45A standards. This standard provides guidance on the application of existing IEC/ISO standards covering design and qualification of system and equipment for RMS. This standard is an application supplement of IEC 61513 as shown in Annex B, and it is not intended that this standard limits the application of other IEC 61513 requirements to RMS lifecycle.

For general requirements and guidance, the following standards provide requirements and guidance for RMS. IEC 61513 is the first level standard of SC 45A standards, and provides general requirements for I&C systems and equipment that are used to perform functions important to safety in NPPs. IEC 61226 provides the criteria for classification of instrumentation and control functions. Most modern RMSs contain computer-based equipment. Hence RMS should often be treated as computer-based system. So following standards required for computer-based system are generally applicable to RMS. IEC 60880 provides the software requirements for category A functions and IEC 62138 provides the software requirements for Category B or C functions. IEC 60987 provides hardware design requirements for computer-based systems. IEC 62566 provides the requirements for HDL-Programmed Device (HPD) for systems performing category A functions. IEC 62645 provides security requirements for computer based I&C systems. For qualification testing, the following SC 45A standards are applicable. IEC 60780 provides guidance for the environmental qualification and IEC 60980 provides guidance for seismic qualification for equipment performing category A or B functions. IEC 62003 provides the requirements for electromagnetic compatibility testing. In addition, IEC 61250 specifies the leak detection requirements by using RMS.

For radiation monitoring specific requirements, the following standards provide requirements and guidance for RMS. The IEC 60951 series provides guidance on the design and testing of radiation monitoring equipment used for accident and post-accident conditions. The IEC 60761 series provide requirements for equipment for continuous off-line monitoring of radioactivity in gaseous effluent in normal conditions. Some of the SC 45B standards (e.g. Gas offline: IEC 62302, Tritium: IEC 62303) are now replacing the IEC 60761 series. IEC 60861 provides requirements for equipment continuous off-line monitoring of radioactivity in liquid effluent in normal conditions. IEC 60768 provides requirements for equipment for continuous in-line and on-line monitoring of radioactivity in process stream in normal and incident conditions. IEC 61031 provides requirements for equipment for area radiation monitor in normal conditions in conjunction with IEC 60532. IEC 61504 provides requirements for centralized system for plant-wide radiation monitoring in conjunction with the IEC 61559 series which specifies the requirements for centralized system. If the centralized system is a part of the safety parameter display system, IEC 60960 provides the functional design criteria. ISO 2889 gives guidance on gas and particulate sampling. The ISO 4037 series provides calibration methodology for radiation monitors.

The relationship between these various standards is given in Table 1.

**Table 1 – Overview of the standards covering the domain of radiation monitoring in NPPs**

Developer	ISO		IEC		
			SC 45A		SC 45B
Scope	Sampling	Calibration	Accident and post accident conditions	Normal conditions	
Radioactive noble gas off-line monitoring	ISO 2889	ISO 4037-1, ISO 4037-3	IEC 60951-1, IEC 60951-2	N/A	IEC 62302 / IEC 60761-1, IEC 60761-3
Radioactive aerosol off-line monitoring	ISO 2889	ISO 4037-1, ISO 4037-3	IEC 60951-1, IEC 60951-2	N/A	IEC 60761-1, IEC 60761-2
Radioactive iodine off-line monitoring	ISO 2889	ISO 4037-1, ISO 4037-3	IEC 60951-1, IEC 60951-2	N/A	IEC 60761-1, IEC 60761-4
Liquid off-line monitoring	N/A	N/A	N/A	N/A	IEC 60861
Tritium off-line monitoring	N/A	N/A	N/A	N/A	IEC 62303 / IEC 60761-1, IEC 60761-5
On-line or in-line monitoring	N/A	ISO 4037-1, ISO 4037-3	IEC 60951-1, IEC 60951-4	IEC 60768	N/A
Area monitoring	N/A	ISO 4037-1, ISO 4037-3	IEC 60951-1, IEC 60951-3	IEC 61031	IEC 60532
Centralized system	N/A	N/A	IEC 61504, IEC 60960		IEC 61559-1
Classification/basic requirements	N/A	N/A	IEC 61513, IEC 60880, IEC 60987, IEC 61226, IEC 62138, IEC 62566, IEC 62645, IEC 61250		N/A
Qualification	N/A	N/A	IEC 60780, IEC 60980, IEC 62003		IEC 62706

For more details on the structure of the IEC SC 45A standard series, see item d) of this introduction.

### c) Recommendations and limitations regarding the application of this Standard

It is important to note that this standard establishes no additional functional requirements for safety systems. Where requirements are given in this standard, they refer generally to the need to apply other IEC and ISO Standards and specific functional and technical requirements contained in these standards.

To ensure that the standard will continue to be relevant in future years, the emphasis has been placed on issues of principle, rather than specific technologies.

### d) Description of the structure of the IEC SC 45A standard series and relationships with other IEC documents and other bodies documents (IAEA, ISO)

The top-level document of the IEC SC 45A standard series is IEC 61513. It provides general requirements for I&C systems and equipment that are used to perform functions important to safety in NPPs. IEC 61513 structures the IEC SC 45A standard series.

IEC 61513 refers directly to other IEC SC 45A standards for general topics related to categorization of functions and classification of systems, qualification, separation of systems, defence against common cause failure, software aspects of computer-based systems, hardware aspects of computer-based systems, and control room design. The standards referenced directly at this second level should be considered together with IEC 61513 as a consistent document set.

At a third level, IEC SC 45A standards not directly referenced by IEC 61513 are standards related to specific equipment, technical methods, or specific activities. Usually these documents, which make reference to second-level documents for general topics, can be used on their own.

A fourth level extending the IEC SC 45A standard series, corresponds to the Technical Reports which are not normative.

IEC 61513 has adopted a presentation format similar to the basic safety publication IEC 61508 with an overall safety life-cycle framework and a system life-cycle framework. Regarding nuclear safety, it provides the interpretation of the general requirements of IEC 61508-1, IEC 61508-2 and IEC 61508-4, for the nuclear application sector, regarding nuclear safety. In this framework IEC 60880 and IEC 62138 correspond to IEC 61508-3 for the nuclear application sector. IEC 61513 refers to ISO as well as to IAEA GS-R-3 and IAEA GS-G-3.1 and IAEA GS-G-3.5 for topics related to quality assurance (QA).

The IEC SC 45A standards series consistently implements and details the principles and basic safety aspects provided in the IAEA code on the safety of NPPs and in the IAEA safety series, in particular the Requirements NS-R-1, establishing safety requirements related to the design of Nuclear Power Plants, and the Safety Guide NS-G-1.3 dealing with instrumentation and control systems important to safety in Nuclear Power Plants. The terminology and definitions used by SC 45A standards are consistent with those used by the IAEA.

NOTE It is assumed that for the design of I&C systems in NPPs that implement conventional safety functions (e.g. to address worker safety, asset protection, chemical hazards, process energy hazards), international or national standards would be applied, that are based on the requirements of a standard such as IEC 61508.

Withdrawal