



DPC: 23 / 30472818 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 12 April 2023

Origin: International

Latest date for receipt of comments: 31 May 2023

Project No. 2023/00862

Responsible committee: NCE/8 Instrumentation, Control & Electrical Systems of Nuclear Facilities

Interested committees:

Title: BS IEC 63435 Nuclear power plants - Control rooms - Operatoring support system

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

**WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD.
THIS DRAFT IS NOT CURRENT BEYOND 31 May 2023**

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <http://standardsdevelopment.bsigroup.com>

Responsible Committee Secretary: **Mr Andranik Ohanian (BSI)**

Direct tel:

E-mail: andranik.ohanian@bsigroup.com

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
------------------	------------------------

1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

PROJECT NUMBER: IEC 63435 ED1	
DATE OF CIRCULATION: 2023-04-07	CLOSING DATE FOR COMMENTS: 2023-06-30
SUPERSEDES DOCUMENTS: 45A/1418/NP, 45A/1428/RVN	

IEC SC 45A : INSTRUMENTATION, CONTROL AND ELECTRICAL POWER SYSTEMS OF NUCLEAR FACILITIES	
SECRETARIAT: France	SECRETARY: Mr Jean-Paul Bouard
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☒ QUALITY ASSURANCE ☒ SAFETY	

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to submit, with their comments, notification of any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "In Some Countries" clauses. (SEE [AC/22/2007](#) OR [NEW GUIDANCE DOC](#)).

TITLE:

Nuclear power plants – Control rooms – Operatoring support system

NOTE FROM TC/SC OFFICERS:

CONTENTS

FOREWORD	4
INTRODUCTION	6
1 Scope	8
1.1 Object of this standard	8
1.2 Context leading to development of OSS	8
1.3 Use of this standard with related standards	8
2 Normative references	9
3 Terms and definitions	9
control room staff	9
emergency response staff	10
operating procedures	10
operating staff	10
OSS	10
4 Abbreviated terms	10
5 Concept of OSS	11
5.1 Purpose and role	11
5.2 Capabilities	11
5.3 HMI resources	12
5.4 Classes of techniques	12
6 OSS life cycle	12
6.1 General	12
6.2 Project organisation	12
6.3 Design process	13
6.4 Training	14
7 Analysis providing input to OSS design	14
7.1 Needs and constraints assessment	14
7.2 Functional analysis and assignment	15
7.3 Task analysis	15
7.4 Human reliability analysis	15
7.5 Operator time response analysis	15
7.6 Trade-off analysis	16
8 System and functional design	16
8.1 Fundamental functions	16
8.2 Human factors guidelines	17
8.2.1 General design considerations	17
8.2.2 Information display	18
8.2.3 User control of interaction	18
8.2.4 Modes of operation	18
8.3 Safety classification	18
8.4 Performance	18
8.4.1 Reliability and availability	18
8.4.2 Accuracy	19
8.4.3 Response time	19
8.5 Maintainability	19
8.6 Location	19
9 Verification and validation of OSS	19

9.1	General.....	19
9.2	Task support verification	20
9.3	Design verification	20
9.4	Preliminary validation.....	20
Annex A (informative) Examples of OSS applications.....		21
A.1	Safety function monitoring	21
A.2	Task oriented displays	22
A.3	Intelligent alarm handling	22
A.4	Computer-based procedure.....	22
A.5	Reactor core performance monitoring	23
A.6	Plant and main components efficiency and performance monitoring.....	23
A.7	Radiation release monitoring	23
A.8	Early fault detection and diagnosis.....	24
A.9	Equipment diagnosis.....	24
A.10	Maintenance support	25
Bibliography.....		27
Figure 1 – The role and interface of OSS in plant monitoring and control		11
Figure 2 – Design process of OSS		14
Figure 3 – OSS functions to support cognitive activities		17
Table 1 – Fundamental functions and description		16
Table A.2 – OSS types and their utilization area, principal user, plant state		21

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**NUCLEAR POWER PLANTS –
CONTROL ROOMS –
OPERATING SUPPORT SYSTEM**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 63435 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 International Standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

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

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

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

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

The National Committees are requested to note that for this document the stability date is 2025.

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

INTRODUCTION

a) Technical background, main issues and organization of the standard

This IEC standard focuses on operating support system (OSS) used by the operating staff of nuclear power plants (NPPs). OSS assists plant situation assessment and decision making by improving monitoring performance and analysis capability to enhance plant safety, availability and operability. With the use of computer technology, applications of OSS are increasing and becoming current practice.

This standard is intended to be used by nuclear power plant designers, utilities operating staff, systems evaluators and regulatory inspectors.

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

This standard is the third level IEC SC 45A document tackling the generic issue of OSS of NPPs. IEC 60964 is the second level IEC SC 45A document.

IEC 60964 provides requirements of data acquisition and processing, display system and alarm system of the control room. In addition, operator support functions are mentioned in Subclause 8.7.2.5 of IEC 60964:2018, but the specific design requirements are not provided.

This standard is intended to deal with the specific aspects of an OSS, as a supplementary to Subclause 8.7.2.5 of IEC 60964:2018.

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

c) Recommendations and limitations regarding the application of this Standard

This standard is applicable to the new OSS whose conceptual design is initiated after the publication of this standard. The recommendations of the standard may be used for refits, upgrades and modifications of an existing OSS.

This standard establishes functional requirements for OSS of NPPs and focuses on the top-level design considerations of OSS. It also provides the concept of OSS, as well as the design process following the human factors engineering (HFE) programme, the human factors guidelines and the verification & validation (V&V) requirements for OSS design. It does not provide detailed guidance on functional analysis and assignment, task analysis and human machine interface design. The system development and human performance monitoring in operation phases are out of the scope of this standard.

To ensure that this standard will continue to be relevant in the future years, the emphasis has been placed on the issues of principles, rather than the 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 documents of the IEC SC 45A standard series are IEC 61513 and IEC 63046. IEC 61513 provides general requirements for I&C systems and equipment that are used to perform functions important to safety in nuclear power plants.

IEC 63046 provides general requirements for electrical power systems of NPPs; it covers power supply systems including the supply systems of the I&C systems. IEC 61513 and IEC 63046 are to be considered in conjunction and at the same level. IEC 61513 and IEC 63046 structure the IEC SC 45A standard series and shape a complete framework establishing general requirements for instrumentation, control and electrical systems for nuclear power plants.

IEC 61513 and IEC 63046 refer directly to other IEC SC 45A standards for general topics related to categorization of functions and classification of systems, qualification, separation, defence against common cause failure, control room design, electromagnetic compatibility, cybersecurity, software and hardware aspects for programmable digital systems, coordination of safety and security requirements and management of ageing. The standards referenced

directly at this second level should be considered together with IEC 61513 and IEC 63046 as a consistent document set.

At a third level, IEC SC 45A standards not directly referenced by IEC 61513 or by IEC 63046 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.

The IEC SC 45A standards series consistently implements and details the safety and security principles and basic aspects provided in the relevant IAEA safety standards and in the relevant documents of the IAEA nuclear security series (NSS). In particular this includes the IAEA requirements SSR-2/1, establishing safety requirements related to the design of NPPs, the IAEA safety guide SSG-30 dealing with the safety classification of structures, systems and components in NPPs, the IAEA safety guide SSG-39 dealing with the design of instrumentation and control systems for NPPs, the IAEA safety guide SSG-34 dealing with the design of electrical power systems for NPPs, and the implementing guide NSS17 for computer security at nuclear facilities. The safety and security terminology and definitions used by SC 45A standards are consistent with those used by the IAEA.

IEC 61513 and IEC 63046 have adopted a presentation format similar to the basic safety publication IEC 61508 with an overall life-cycle framework and a system life-cycle framework. Regarding nuclear safety, IEC 61513 and IEC 63046 provide the interpretation of the general requirements of IEC 61508-1, IEC 61508-2 and IEC 61508-4, for the nuclear application sector. In this framework IEC 60880, IEC 62138 and IEC 62566 correspond to IEC 61508-3 for the nuclear application sector. IEC 61513 and IEC 63046 refer 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. At level 2, regarding nuclear security, IEC 62645 is the entry document for the IEC SC 45A security standards. It builds upon the valid high level principles and main concepts of the generic security standards, in particular ISO/IEC 27001 and ISO/IEC 27002; it adapts them and completes them to fit the nuclear context and coordinates with the IEC 62443 series. At level 2, regarding control rooms, IEC 60964 is the entry document for the IEC SC 45A control rooms standards and IEC 62342 is the entry document for the IEC SC 45A ageing management standards.

NOTE 1 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.

NOTE 2 IEC TR 63400 provides a more comprehensive description of the overall structure of the IEC SC 45A standards series and of its relationship with other standards bodies and standards.