

This is a preview - click here to buy the full publication



IEEE

IEC 63147

Edition 1.0 2017-12

**INTERNATIONAL
STANDARD**

IEEE Std 497™

Criteria for accident monitoring instrumentation for nuclear power generating stations

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.120.20

ISBN 978-2-8322-5031-0

Warning! Make sure that you obtained this publication from an authorized distributor.

Contents

1. Overview	1
1.1 Scope	1
1.2 Purpose	1
1.3 Application	1
2. Normative references.....	2
2.1 Normative references for IEEE domain.....	2
2.2 Normative references for IEC domain.....	3
3. Definitions	3
4. Selection criteria.....	6
4.1 Type A variables.....	6
4.2 Type B variables.....	6
4.3 Type C variables.....	7
4.4 Type D variables.....	7
4.5 Type E variables.....	7
4.6 Type F variables.....	8
4.7 Documentation of selection criteria.....	8
5. Performance criteria	9
5.1 Range.....	9
5.2 Accuracy.....	9
5.3 Response time.....	10
5.4 Required operating time	10
5.5 Reliability	10
5.6 Documentation of performance criteria.....	10
6. Design criteria	11
6.1 Single failure.....	11
6.2 Common cause failure	11
6.3 Independence and physical separation.....	11
6.4 Isolation	12
6.5 Information ambiguity	12
6.6 Power supply	13
6.7 Calibration	13
6.8 Testability	13
6.9 Direct measurement.....	14
6.10 Control of access	14
6.11 Maintenance and repair.....	14
6.12 Minimizing measurements.....	14
6.13 Auxiliary supporting features	14
6.14 Portable instruments	15
6.15 Documentation of design criteria.....	15
7. Qualification criteria.....	15
7.1 Type A variables.....	15
7.2 Type B variables.....	15
7.3 Type C variables.....	16
7.4 Type D variables.....	16
7.5 Type E variables.....	16

7.6 Type F variables	16
7.7 Portable instruments	17
7.8 Operating time	17
7.9 Documentation of qualification criteria	17
8. Display criteria	17
8.1 Display characteristics	17
8.2 Trend or rate information.....	18
8.3 Display identification.....	18
8.4 Type of monitoring channel display	18
8.5 Display location.....	18
8.6 Information ambiguity	19
8.7 Recording	19
8.8 Digital display signal validation	19
8.9 Documentation of display criteria.....	19
9. Quality assurance.....	19
Annex A (informative) Accident monitoring instrument channel accuracy	20
A.1 Introduction	20
A.2 Accuracy requirement groupings according to usage	20
A.3 Typical accuracy requirements	20
Annex B (informative) Examples of monitoring channel displays.....	21
Annex C (informative) Operational state diagram	23
Annex D (informative) Bibliography	24
Annex E (informative) IEEE list of participants	25

CRITERIA FOR ACCIDENT MONITORING INSTRUMENTATION FOR NUCLEAR POWER GENERATING STATIONS

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.

IEEE Standards documents are developed within IEEE Societies and Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. IEEE develops its standards through a consensus development process, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of IEEE and serve without compensation. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards. Use of IEEE Standards documents is wholly voluntary. IEEE documents are made available for use subject to important notices and legal disclaimers (see <http://standards.ieee.org/IPR/disclaimers.html> for more information).

IEC collaborates closely with IEEE in accordance with conditions determined by agreement between the two organizations.

- 2) The formal decisions 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. The formal decisions of IEEE on technical matters, once consensus within IEEE Societies and Standards Coordinating Committees has been reached, is determined by a balanced ballot of materially interested parties who indicate interest in reviewing the proposed standard. Final approval of the IEEE standards document is given by the IEEE Standards Association (IEEE-SA) Standards Board.
- 3) IEC/IEEE Publications have the form of recommendations for international use and are accepted by IEC National Committees/IEEE Societies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC/IEEE Publications is accurate, IEC or IEEE 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 (including IEC/IEEE Publications) transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC/IEEE Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC and IEEE do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC and IEEE are 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 IEEE or their directors, employees, servants or agents including individual experts and members of technical committees and IEC National Committees, or volunteers of IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board, 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/IEEE Publication or any other IEC or IEEE 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 implementation of this IEC/IEEE Publication may require use of material covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. IEC or IEEE shall not be held responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patent Claims or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

International Standard IEC 61347/IEEE Std 497™-2016 has been processed through IEC subcommittee 45A: Instrumentation, control and electrical power systems of nuclear facilities, under the IEC/IEEE Dual Logo Agreement.

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

IEEE Std	FDIS	Report on voting
IEEE Std 497™-2016	45A/1167/FDIS	45A/1170/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.

When applied in an IEC / IAEA environment this standard is to be used in conjunction with IEC TR 63123:2017, Nuclear power plants – Instrumentation, control and electrical power systems – Guidance for the application of IEC 63147:2017 / IEEE 497-2016 in the IEC / IAEA framework.

The IEC Technical Committee and IEEE Technical Committee have 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.

IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations

Sponsor

Nuclear Power Engineering Committee
of the
IEEE Power and Energy Society

Approved 15 May 2016

IEEE-SA Standards Board

Abstract: Established in this standard are criteria for variable selection, performance, design, and qualification of accident monitoring instrumentation for anticipated operational, design basis events and severe accidents.

Keywords: accident monitoring, design criteria, display criteria, IEEE 497™, performance criteria, selection criteria, severe accidents, type variables

Important Notices and Disclaimers Concerning IEEE Standards Documents

IEEE documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page, appear in all standards and may be found under the heading “Important Notice” or “Important Notices and Disclaimers Concerning IEEE Standards Documents.”

Notice and Disclaimer of Liability Concerning the Use of IEEE Standards Documents

IEEE Standards documents (standards, recommended practices, and guides), both full-use and trial-use, are developed within IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (“IEEE-SA”) Standards Board. IEEE (“the Institute”) develops its standards through a consensus development process, approved by the American National Standards Institute (“ANSI”), which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims all warranties (express, implied and statutory) not included in this or any other document relating to the standard, including, but not limited to, the warranties of: merchantability; fitness for a particular purpose; non-infringement; and quality, accuracy, effectiveness, currency, or completeness of material. In addition, IEEE disclaims any and all conditions relating to: results; and workmanlike effort. IEEE standards documents are supplied “AS IS” and “WITH ALL FAULTS.”

Use of an IEEE standard is wholly voluntary. The existence of an IEEE standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

IN NO EVENT SHALL IEEE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE PUBLICATION, USE OF, OR RELIANCE UPON ANY STANDARD, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE AND REGARDLESS OF WHETHER SUCH DAMAGE WAS FORESEEABLE.

Translations

The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

Official statements

A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered or inferred to be the official position of IEEE or any of its committees and shall not be considered to be, or be relied upon as, a formal position of IEEE. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.

Comments on standards

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to comments or questions except in those cases where the matter has previously been addressed. For the same reason, IEEE does not respond to interpretation requests. Any person who would like to participate in revisions to an IEEE standard is welcome to join the relevant IEEE working group.

Comments on standards should be submitted to the following address:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854 USA

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

IEEE draft and approved standards are copyrighted by IEEE under U.S. and international copyright laws. They are made available by IEEE and are adopted for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making these documents available for use and adoption by public authorities and private users, IEEE does not waive any rights in copyright to the documents.

Photocopies

Subject to payment of the appropriate fee, IEEE will grant users a limited, non-exclusive license to photocopy portions of any individual standard for company or organizational internal use or individual, non-commercial use only. To arrange for payment of licensing fees, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Updating of IEEE Standards documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect.

Every IEEE standard is subjected to review at least every ten years. When a document is more than ten years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE-SA Website at <http://ieeexplore.ieee.org/Xplore/home.jsp> or contact IEEE at the address listed previously. For more information about the IEEE-SA or IEEE's standards development process, visit the IEEE-SA Website at <http://standards.ieee.org>.

Errata

Errata, if any, for all IEEE standards can be accessed on the IEEE-SA Website at the following URL: <http://standards.ieee.org/findstds/errata/index.html>. Users are encouraged to check this URL for errata periodically.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at <http://standards.ieee.org/about/sasb/patcom/patents.html>. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

IEEE Introduction

This introduction is not part of IEEE Std 497™-2016, IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations.

History

This standard evolved from IEEE Std 497™-2010 [B4]¹. It represents a continued effort by IEEE to support the specification, design, and implementation of accident monitoring instrumentation of nuclear power generating stations.

IEEE Std 497-2010 [B4] was developed to provide criteria for advanced instrumentation system designs and design modifications based on modern digital technology. It marked a clear path forward for the application of new technology. Though still maintaining applicability to existing systems, this version of IEEE Std 497 provides more current guidance based on historically related standards and guidance.

It was the working group's intention that the criteria of this standard address the variety of possible accident monitoring channel configurations that current technology affords. It was also the working group's intention to address the display of information using computer generated displays and calculated values. The criteria presented in this standard provide guidance in this area without limiting the types of displays that can be made available to accident management personnel.

Although written primarily for new plant designs, existing plants may also use the guidance and applicable criteria in this standard. The use of applicable plant procedures to determine the requirements of the accident monitoring instrumentation provides the necessary flexibility for useful design criteria. This standard can be used to help address the necessary changes to the plant configuration that occur over the operating life of any plant.

Historically the standard addressed accident monitoring instrumentation used for anticipated operating occurrences (AOOs) and design basis events (DBEs). To address lessons learned from various industry events, the scope of this standard has evolved to now include severe accidents. This evolution was intended to provide a broader applicability to cover both preventative and mitigative phases of potential plant events. A broader applicability of the standard was also achieved by moving to a more international, technology neutral approach to the standard. This approach was achieved by changing to International Atomic Energy Agency (IAEA) definitions of terms, where applicable; the removal, where appropriate, of U.S. specific references; and involvement in the working group of members of other standards organizations. Furthermore, the corresponding International Electrotechnical Commission (IEC) counterparts to the IEEE standards referenced were investigated and introduced as a second set of normative references. This opens the possibility to apply this standard in the IEC domain. The individual IEEE and IEC reference sets in whole are individually appropriate for use in the application of the standard, but inclusion of the IEEE and IEC references does not imply equivalency between the individual references of the two sets.

Intended use

The standard applies to instrumentation intended for use during anticipated operational occurrences (AOO), design basis events (DBE), and design extension conditions (DEC) including severe accidents.

This standard defines severe accidents as a subset of design extension conditions during which fuel damage has occurred. Operationally, severe accidents and design extension conditions without fuel damage are

¹ The numbers in brackets correspond to those of the bibliography in Annex D.

distinguished by the procedures and guidelines used to manage the event, with emergency operating procedures (EOP) used for design extension conditions without fuel damage and severe accident mitigation guidelines (SAMG) used for severe accidents (see Annex C).

The standard is to be applied to instruments designated for severe accidents (Type F variables); however, use of non-designated instruments during a severe accident is not precluded if these instruments are available and can aid in the accident mitigation. Design extension conditions that are not severe accidents are not covered by this standard.

This standard is intended to be used for both new plant designs and major modifications or upgrades of existing nuclear power generating stations. The standard can be applied to various reactor types used for power generation; however, development of the standard focused on light water reactors and application of the standard to reactor technologies beyond light water reactors should be evaluated prior to initial use.

Revision summary

Since IEEE Std 497 was approved in 2010, industry events have occurred that highlighted the need for the standard to address not just design basis events but severe accidents as well. The working group has considered and incorporated appropriate changes related to the following significant items:

- Lessons learned from industry events including Fukushima (earthquake and tsunami), Browns Ferry (tornado), Salem (loss of RPS due to CCF), and North Anna (earthquake)
- Accident monitoring instrument requirements based on emergency procedures and guidelines (EOPs and SAMGs)
- Reactor technology neutral approach
- International usability
- User feedback
- Requirements for severe accidents instrumentation
- IAEA definitions

Other minor editorial improvements throughout the standard were also incorporated.

Future work

As the use of digital technology in the nuclear plant is a dynamic area of design, the working group intends to keep this area as an ongoing future task.

Since no counterpart to this standard exists in the IEC domain, this standard was identified as a potential candidate for a dual-logo standard to be applied in both the IEEE and the IEC domain early in the course of this revision. A joint group of both organizations identified topics and aspects to be harmonized and recommended to proceed. Thus the recent revision was performed with the intent and the spirit to prepare and facilitate the application for the IEC domain. Formal involvement of the IEC was delayed. This revision of the standard is, therefore, still an IEEE standard, but may be further modified in the future after closer investigation by and discussion with IEC experts on its potential as a dual-logo standard.

Another area that the working group believes should be considered in a future revision to the standard is how to adopt risk-informed techniques into accident monitoring criteria.

Additionally, user feedback related to the implementation of the standard on non-light water reactors and implementation of Type F variables will be reviewed and considered for a future revision.

Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations

IMPORTANT NOTICE: IEEE Standards documents are not intended to ensure safety, security, health, or environmental protection, or ensure against interference with or from other devices or networks. Implementers of IEEE Standards documents are responsible for determining and complying with all appropriate safety, security, environmental, health, and interference protection practices and all applicable laws and regulations.

This IEEE document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading “Important Notice” or “Important Notices and Disclaimers Concerning IEEE Documents.” They can also be obtained on request from IEEE or viewed at <http://standards.ieee.org/IPR/disclaimers.html>.

1. Overview

1.1 Scope

This standard contains the functional and design criteria for accident monitoring instrumentation for new plant designs and nuclear power generating stations desiring to perform design modifications.

1.2 Purpose

The purpose of this standard is to establish selection, design, performance, qualification, and display criteria for accident monitoring instrumentation for anticipated operational occurrences, design basis events, and severe accidents.

1.3 Application

This standard applies to accident monitoring instrumentation intended for use during the following operations:

- As required for planned operator action related to accident mitigation

- For assessing plant conditions, safety system performance, and making decisions related to plant response to abnormal events
- For achieving and maintaining safe shutdown following an accident

This standard does not apply to the following:

- Accident monitoring instrumentation that is intended solely for historical recording or solely for maintenance purposes
- Other instrumentation that may be available during accident conditions

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

2.1 Normative references for IEEE domain

ASME NQA-1-2008, Quality Assurance Requirements for Nuclear Facility Applications.²

IEEE Std 7-4.3.2TM-2016, IEEE Standard Criteria for Programmable Digital Devices in Safety Systems of Nuclear Power Generating Stations.^{3,4}

IEEE Std 308TM-2012, IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations.

IEEE Std 323TM-2003, IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.

IEEE Std 344TM-2013, IEEE Standard for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.

IEEE Std 352TM-1987, IEEE Guide for General Principles of Reliability Analysis of Nuclear Power Stations.

IEEE Std 379TM-2014, IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems.

IEEE Std 384TM-2008, IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits.

IEEE Std 577TM-2012, IEEE Standard Requirements for Reliability Analysis in the Design and Operation of Safety Systems for Nuclear Power Generating Stations.

IEEE Std 603TM-2009, IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations.

² ASME publications are available from the American Society of Mechanical Engineers, 22 Law Drive, Fairfield, NJ 07007, USA.

³ The IEEE standards or products referenced in Clause 2 are trademarks owned by The Institute of Electrical and Electronics Engineers, Incorporated.

⁴ IEEE publications are available from The Institute of Electrical and Electronics Engineers, 445 Hose Lane, Piscataway, NJ 08854.

2.2 Normative references for IEC domain

IAEA GS-R-3:2006, The Management System for Facilities and Activities.⁵

IEC 60880:2006, Nuclear power plants—Instrumentation and control systems important to safety—Software aspects for computer-based systems performing category A functions.⁶

IEC 61225:2005, Nuclear power plants—Instrumentation and control systems important to safety—Requirements for electrical supplies.

IEC 60780:1998, Nuclear power plants—Electrical equipment of the safety system—Qualification.

IEC 60980:1989, Recommended practices for seismic qualification of electrical equipment of the safety system for nuclear generating stations.

IEC 60812:2008, Analysis techniques for system reliability—Procedure for failure mode and effects analysis (FMEA).

IEC 62340:2007, Nuclear power plants—Instrumentation and control systems important to safety—Requirements for coping with common cause failure (CCF).

IEC 60709:2004, Nuclear power plants—Instrumentation and control systems important to safety—Separation.

⁵ IAEA publications are available from the International Atomic Energy Agency, Vienna International Centre, PO Box 100, A-1400 Vienna, Austria

⁶ IEC publication are available from the International Electrotechnical Commission, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland