CSA Group

N290.6-16

Requirements for monitoring and display of nuclear power plant safety functions in the event of an accident

Legal Notice for Standards

Canadian Standards Association (operating as "CSA Group") develops standards through a consensus standards development process approved by the Standards Council of Canada. This process brings together volunteers representing varied viewpoints and interests to achieve consensus and develop a standard. Although CSA Group administers the process and establishes rules to promote fairness in achieving consensus, it does not independently test, evaluate, or verify the content of standards.

Disclaimer and exclusion of liability

This document is provided without any representations, warranties, or conditions of any kind, express or implied, including, without limitation, implied warranties or conditions concerning this document's fitness for a particular purpose or use, its merchantability, or its non-infringement of any third party's intellectual property rights. CSA Group does not warrant the accuracy, completeness, or currency of any of the information published in this document. CSA Group makes no representations or warranties regarding this document's compliance with any applicable statute, rule, or regulation.

IN NO EVENT SHALL CSA GROUP, ITS VOLUNTEERS, MEMBERS, SUBSIDIARIES, OR AFFILIATED COMPANIES, OR THEIR EMPLOYEES, DIRECTORS, OR OFFICERS, BE LIABLE FOR ANY DIRECT, INDIRECT, OR INCIDENTAL DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES, HOWSOEVER CAUSED, INCLUDING BUT NOT LIMITED TO SPECIAL OR CONSEQUENTIAL DAMAGES, LOST REVENUE, BUSINESS INTERRUPTION, LOST OR DAMAGED DATA, OR ANY OTHER COMMERCIAL OR ECONOMIC LOSS, WHETHER BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), OR ANY OTHER THEORY OF LIABILITY, ARISING OUT OF OR RESULTING FROM ACCESS TO OR POSSESSION OR USE OF THIS DOCUMENT, EVEN IF CSA GROUP HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES.

In publishing and making this document available, CSA Group is not undertaking to render professional or other services for or on behalf of any person or entity or to perform any duty owed by any person or entity to another person or entity. The information in this document is directed to those who have the appropriate degree of experience to use and apply its contents, and CSA Group accepts no responsibility whatsoever arising in any way from any and all use of or reliance on the information contained in this document.

CSA Group is a private not-for-profit company that publishes voluntary standards and related documents. CSA Group has no power, nor does it undertake, to enforce compliance with the contents of the standards or other documents it publishes.

Intellectual property rights and ownership

As between CSA Group and the users of this document (whether it be in printed or electronic form), CSA Group is the owner, or the authorized licensee, of all works contained herein that are protected by copyright, all trade-marks (except as otherwise noted to the contrary), and all inventions and trade secrets that may be contained in this document, whether or not such inventions and trade secrets are protected by patents and applications for patents. Without limitation, the unauthorized use, modification, copying, or disclosure of this document may violate laws that protect CSA Group's and/or others' intellectual property and may give rise to a right in CSA Group and/or others to seek legal redress for such use, modification, copying, or disclosure. To the extent permitted by licence or by law, CSA Group reserves all intellectual property rights in this document.

Patent rights

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights. CSA Group shall not be held responsible for identifying any or all such patent rights. Users of this standard are expressly advised that determination of the validity of any such patent rights is entirely their own responsibility.

Authorized use of this document

This document is being provided by CSA Group for informational and non-commercial use only. The user of this document is authorized to do only the following:

If this document is in electronic form:

- load this document onto a computer for the sole purpose of reviewing it;
- search and browse this document; and
- print this document if it is in PDF format.

Limited copies of this document in printed or paper form may be distributed only to persons who are authorized by CSA Group to have such copies, and only if this Legal Notice appears on each such copy.

In addition, users may not and may not permit others to

- alter this document in any way or remove this Legal Notice from the attached standard;
- sell this document without authorization from CSA Group; or
- make an electronic copy of this document.

If you do not agree with any of the terms and conditions contained in this Legal Notice, you may not load or use this document or make any copies of the contents thereof, and if you do make such copies, you are required to destroy them immediately. Use of this document constitutes your acceptance of the terms and conditions of this Legal Notice.

CSA Group

Standards Update Service

N290.6-16
August 2016

Title: *Requirements for monitoring and display of nuclear power plant safety functions in the event of an accident*

To register for e-mail notification about any updates to this publication
- go to **shop.csa.ca**
- click on **CSA Update Service**

The **List ID** that you will need to register for updates to this publication is **2124155**.

If you require assistance, please e-mail **techsupport@csagroup.org** or call 416-747-2233.

Visit CSA Group's policy on privacy at **www.csagroup.org/legal** to find out how we protect your personal information.

N290.6-16

Requirements for monitoring and display of nuclear power plant safety functions in the event of an accident

Published in August 2016 by CSA Group
A not-for-profit private sector organization
178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3

*To purchase standards and related publications, visit our Online Store at **shop.csa.ca***
or call toll-free 1-800-463-6727 or 416-747-4044.

ISBN 978-1-4883-0401-9

Contents

Technical Committee on Reactor Control Systems, Safety Systems, and Instrumentation for Nuclear Power Plants

R.K. Black	TransCanada, Toronto, Ontario *Category: Service Industry*	*Chair*
B.J. Coulas	Hatch Ltd, Mississauga, Ontario *Category: Service Industry*	*Vice-Chair*
M. Kattan	Candu Energy, Mississauga, Ontario *Category: Supplier/Fabricator/Contractor*	*Vice-Chair*
B.D. Babcock	North York, Ontario *Category: General Interest*	
M. Borairi	Candu Energy, Mississauga, Ontario	*Associate*
M. Buckler	Bruce Power, Tiverton, Ontario	*Associate*
J.R. Burnett	RCM Technologies Canada Corp., Pickering, Ontario	*Associate*
Q.B. Chou	Canadian Power Utility Services Ltd (CPUS), Toronto, Ontario *Category: Service Industry*	
V. Chugh	Power Generation Integrated Engineering, Toronto, Ontario	*Associate*
R. Clavero	CANDU Owners Group Inc., Toronto, Ontario	*Associate*
J. Coady	Bruce Power L.P., Tiverton, Ontario *Category: Owner/Operator/Producer*	

C.J. Conway	Canadian Nuclear Laboratories Limited (CNL), Chalk River, Ontario *Category: Owner/Operator/Producer*	
J.M. Cuttler	Cuttler & Associates Inc., Mississauga, Ontario	*Associate*
C.M. Daniel	RCM Technologies Canada Corp., Pickering, Ontario *Category: Service Industry*	
M. Derewonko	Bruce Power L.P., Tiverton, Ontario	*Associate*
I. Dimitrov	Ontario Power Generation Inc., Pickering, Ontario	*Associate*
H. Gaber	University of Ontario Institute of Technology (UOIT), Oshawa, Ontario *Category: General Interest*	
M. Gerard	Ajax, Ontario *Category: General Interest*	
D.L. Gillard	Ontario Power Generation, Oshawa, Ontario	*Associate*
J. Grava	CANTECH Associates Ltd, Owen Sound, Ontario *Category: General Interest*	
S. Hilts	Bruce Power, Tiverton, Ontario	*Associate*
U. Kukreti	Markham, Ontario	*Associate*
W.K. Lam	Ontario Ministry of Energy, Toronto, Ontario *Category: Government and/or Regulatory Authority*	
G. Lamarre	Canadian Nuclear Safety Commission (CNSC), Ottawa, Ontario *Category: Government and/or Regulatory Authority*	

L. Luckhardt	GE Oil & Gas, Dundas, Ontario *Category: Supplier/Fabricator/Contractor*	
G. Mirzaei	SNC-Lavalin Nuclear Inc., Oakville, Ontario *Category: Supplier/Fabricator/Contractor*	
S. Ostrowski	Bruce Power, Tiverton, Ontario	*Associate*
Y. Parlatan	Ontario Power Generation Inc., Pickering, Ontario *Category: Owner/Operator/Producer*	
H. Payne	GE-Hitachi Nuclear Energy Canada Inc., Peterborough, Ontario *Category: Supplier/Fabricator/Contractor*	
J. Sams	Ontario Power Generation Inc., Pickering, Ontario	*Associate*
B. Willemsen	NB Power Nuclear Corporation, Lepreau, New Brunswick *Category: Owner/Operator/Producer*	
R. Reipas	CSA Group, Toronto, Ontario	*Project Manager*

Subcommittee on Requirements for Monitoring and Display of Nuclear Power Plant Safety Functions in the Event of an Accident

D.L. Gillard	Ontario Power Generation, Oshawa, Ontario	*Chair*
P. Castaldo	Canadian Power Utility Services Ltd (CPUS), Toronto, Ontario	
C. Cole	Canadian Nuclear Safety Commission (CNSC), Ottawa, Ontario	
J.M. Cuttler	Cuttler & Associates Inc., Mississauga, Ontario	
N. Dadashi	Candesco, Toronto, Ontario	
S. Donnelly	Amec Foster Wheeler, Toronto, Ontario	
P. Foster	Candu Energy, Mississauga, Ontario	
H. Gaber	University of Ontario Institute of Technology (UOIT), Oshawa, Ontario	
L. Gilbert	Bruce Power, Tiverton, Ontario	
D. Guentcheva	Thornhill, Ontario	
M. Kattan	Candu Energy, Mississauga, Ontario	
M. Lewis	Canadian Nuclear Laboratories Limited (CNL), Chalk River, Ontario	

E. Nasimi	Bruce Power, Tiverton, Ontario	
N. Persaud	Amec Foster Wheeler, Toronto, Ontario	
M. Velayuthan	Ontario Power Generation Inc. — Pickering NGS, Pickering, Ontario	
Z. Zeng	Canadian Nuclear Safety Commission (CNSC), Ottawa, Ontario	
R. Reipas	CSA Group, Toronto, Ontario	*Project Manager*

Preface

This is the third edition of CSA N290.6, *Requirements for monitoring and display of nuclear power plant safety functions in the event of an accident.* It supersedes the previous editions, published in 2009 and 1982.

Major changes to this edition include new requirements, guidance, and recommendations for design extension condition monitoring as a subset of beyond design basis accidents. The scope of this standard has been broadened to include requirements for monitoring of irradiated fuel bays under design extension conditions.

Consistent with industry initiatives to further classify and subdivide the beyond design basis accident regime, the informative annex on severe accidents in the 2009 edition has been incorporated into the body of the standard to the extent it is applicable to accident monitoring for design extension conditions. Other requirements for beyond design basis accidents are addressed in the CSA N290.16 standard.

The CSA N-Series Standards provide an interlinked set of requirements for the management of nuclear facilities and activities. The CSA N286 Standard provides overall direction to management to develop and implement sound management practices and controls while the other CSA nuclear Standards provide specific technical requirements and guidance that support the management system. This Standard works in harmony with CSA N286 and does not duplicate the generic requirements of CSA N286; however, it can provide more specific direction for meeting those requirements.

This Standard provides requirements and recommendations for the design and qualification of those components specifically involved in the monitoring and display of safety functions for a nuclear reactor. The monitoring and display of nuclear power plant variables following an accident are important safety functions; appropriate operator actions following such an event rely on the availability of essential information.

Users of this Standard are reminded that additional and site-specific requirements might be specified by federal, provincial/territorial, or municipal authorities. This Standard should not be considered a replacement for the requirements contained in any

a) applicable federal/territorial, or provincial statute, including the Nuclear Safety and Control Act; or
b) regulation, license, or permit issued pursuant to an applicable statute.

This Standard was prepared by the Subcommittee on Requirements for Monitoring and Display of Nuclear Power Plant Safety Functions in the Event of an Accident, under the jurisdiction of the Technical Committee on Reactor Control Systems, Safety Systems, and Instrumentation for Nuclear Power Plants and the Strategic Steering Committee on Nuclear Standards, and has been formally approved by the Technical Committee.

Notes:

1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*

2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*

3) *This Standard was developed by consensus, which is defined by* CSA Policy governing standardization — Code of good practice for standardization *as "substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*

4) *To submit a request for interpretation of this Standard, please send the following information to inquiries@csagroup.org and include "Request for interpretation" in the subject line:*

a) *define the problem, making reference to the specific clause, and, where appropriate, include an*
b) *illustrative sketch;*
c) *provide an explanation of circumstances surrounding the actual field condition; and*
d) *where possible, phrase the request in such a way that a specific "yes" or "no" answer will address the issue.*

Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization *and are available on the* Current Standards Activities *page at standardsactivities.csa.ca.*

5) *This Standard is subject to review five years from the date of publication. Suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line:*

a) *Standard designation (number);*
b) *relevant clause, table, and/or figure number;*
c) *wording of the proposed change; and*
d) *rationale for the change.*

N290.6-16
Requirements for monitoring and display of nuclear power plant safety functions in the event of an accident

1 Scope

1.1

This Standard provides requirements for the design and qualification of components for the monitoring and display of nuclear power plants (NPP) and irradiated fuel bay safety functions in the event of a design basis accident (DBA) or a design extension condition (DEC).

Note: *The requirements for a DBA and those for a DEC might differ. Where requirements differ for a DBA and a DEC, the difference is explicitly stated.*

1.2

This Standard applies to existing NPPs and new NPPs.

Notes:

1) *The requirements for new plants and existing plants might differ. Where requirements differ for new plants and existing plants, the difference is explicitly stated.*

2) *This Standard may provide guidance for nuclear facilities other than NPPs, using a graded approach.*

1.3

This Standard addresses the specific requirements for the monitoring and display of safety functions under DECs.

Note: *Requirements and guidance regarding DECs [as a subset of beyond design basis accidents (BDBAs)] are covered in CSA N290.16.*

1.4

This Standard applies to components and systems that enable NPP staff, in the event of an accident, to

a) monitor the plant safety functions;

   Note: *The purpose of monitoring the plant safety functions is to guide operator actions that might be required as a part of the accident response.*

b) monitor plant conditions for the purposes of accident management; and

   Note: *Accident management refers to specific actions taken within the NPP during the evolution of an accident to prevent escalation, mitigate consequences, and to achieve a long-term controlled stable state. Accident management actions are the responsibility of the plant operator. Refer to CNSC REGDOC-2.3.2 for further clarification.*

c) monitor parameters for the initiation of on-site and off-site emergency management.

   Note: *Emergency management in this context refers to the overall coordinated response to, mitigation of, and recovery from a nuclear emergency. Emergency management is not concerned with the specific actions taken within the NPP to manage the accident (i.e., accident management as described above). Emergency management actions can be the responsibility of the operating organization or other jurisdictions (e.g., operator emergency response organizations, government bodies, emergency workers). Refer to CSA N1600 for guidance on nuclear emergency categorization and notification.*

1.5

This Standard applies only to the functions associated with monitoring in the event of an accident; other monitoring functions are beyond the scope of this Standard.

Plant systems, including safety systems and process control systems, can provide functions associated with monitoring in the event of an accident as a part of the design.

Note: *The design of monitoring capability for process and safety systems are covered in other CSA N290 Standards.*

1.6

In this Standard, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the Standard; "should" is used to express a recommendation or that which is advised but not required; and "may" is used to express an option or that which is permissible within the limits of the Standard.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

1.7

In this Standard, "shall be considered" or "shall consider" means that the user evaluates the impact and documents any decisions.

Note: *Examples can include no action, operating procedures, design features.*

2 Reference publications

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto.

Note: *See also Annex A.*

CSA Group

N285.0-12/N285.6 Series-12
General requirements for pressure-retaining systems and components in CANDU nuclear power plants/ Material Standards for reactor components for CANDU nuclear power plants

N286-12
Management system requirements for nuclear facilities

N288.2-14
Guidelines for calculating the radiological consequences to the public of a release of airborne radioactive material for nuclear reactor accidents