

# Requirements for reactor control systems of nuclear power plants



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# Preface

This is the second edition of CSA N290.4, *Requirements for reactor control systems of nuclear power plants*. It supersedes the previous edition published in 1982. The title has been changed to reflect a change of scope. The new edition not only addresses CANDU reactors but also addresses other types of water-cooled power reactors.

The development of the original Standard was initiated by the Canadian Nuclear Association to help prospective owners of nuclear power plants, as well as designers, manufacturers, fabricators, and installers of nuclear power plant components, by compiling the various requirements of regulatory authorities.

Major changes to this edition include

- (a) broadening of requirements to incorporate other water-cooled reactor technologies;
- (b) improved integration with associated standards; and
- (c) incorporation of current terminology and operating experience.

The specific objective of this Standard is to establish the minimum requirements for the design, manufacture and fabrication, qualification, and installation of reactor control systems in nuclear power plants, in order to ensure that they will operate as intended. The purpose of this Standard is not to limit improved system design but to provide a minimum base against which innovations and new techniques can be compared.

The CSA N-Series of Standards provides an interlinked set of requirements for the management of nuclear facilities and activities. CSA N286 provides overall direction to management to develop and implement sound management practices and controls, while the other CSA nuclear Standards provide 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 may provide more specific direction for those requirements.

Users of this Standard are reminded that the design, manufacture, construction, commissioning, operation, and decommissioning of nuclear facilities in Canada are subject to the provisions of the *Nuclear Safety and Control Act* and its supporting Regulations.

This Standard has been prepared by the Subcommittee on Reactor Control Systems of Nuclear Power Plants, under the jurisdiction of the Technical Committee on Reactor Control Systems, Safety Systems, and Instrumentation of Nuclear Power Plants, and the Standards Steering Committee on Nuclear Standards.

October 2011

## 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 publication 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 publication.
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- (d) rationale for the change.*

# N290.4-11

## ***Requirements for reactor control systems of nuclear power plants***

### **1 Scope**

#### **1.1**

This Standard specifies provisions for safe and effective control of reactor power.

#### **1.2**

This Standard pertains to all components of the system, including mechanical, process, software, electrical, and instrumentation and control design used for the control of the neutron flux and the thermal output of the reactor.

#### **1.3**

In this Standard, “control” refers to both manual and automatic action.

#### **1.4**

In this Standard, “control” refers to reactor power control, not overall unit control.

#### **1.5**

This Standard provides provisions for a design that facilitates reactivity management.

**Note:** For the purposes of this Standard, “reactivity management” refers to

- (a) the safe, controlled, and conservative performance of plant operation and maintenance activities that affect reactivity;
- (b) the active and vigilant monitoring of reactivity changes;
- (c) the quick and reliable detection of deviations from expected results; and
- (d) limiting rate changes and maximum power changes in response to failures.

#### **1.6**

In CSA standards, “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 (nonmandatory) to define their application.