CANADIAN STANDARDS ASSOCIATION

N289.3-10

Design procedures for seismic qualification of nuclear power plants

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Preface

This is the second edition of CSA N289.3, *Design procedures for seismic qualification of nuclear power plants*. It supersedes the previous edition, published in 1981 under the title *Design Procedures For Seismic Qualification of CANDU Nuclear Power Plants*. The title has been changed to reflect a scope change, from addressing only CANDU® reactors to including any nuclear power plant.

Note: *CANDU (CANada Deuterium Uranium) is a registered trademark of Atomic Energy of Canada Limited (AECL).*

Standards in the CSA N289 series of Standards are developed in response to a recognition by the utilities and industries concerned with nuclear facilities in Canada of a need for the documentation of standards applicable to the seismic design and qualification of nuclear structures, systems, and components (SSCs) of nuclear power plants. Although the CSA N289 series of Standards includes regulatory requirements in addition to those of a technical nature, users of this Standard should recognize that it has the force of law only when adopted by the Canadian Nuclear Safety Commission (CNSC) or the appropriate regulatory body (in countries other than Canada).

The purpose of this Standard is to provide requirements that ensure that the nuclear SSCs are designed and seismically qualified in a manner using analytical techniques that meet a quality and standard commensurate with the safety principles necessary to comply with the Canadian nuclear safety philosophy.

The CSA N289 series of Standards consists of five Standards. Some of the objectives of each Standard are summarized as follows:

(a) CSA N289.1-08, *General requirements for seismic design and qualification of CANDU nuclear power plants* — to provide guidelines for identifying structures and systems requiring seismic qualification based on nuclear safety considerations;
(b) CSA N289.2-10, *Ground motion determination for seismic qualification of nuclear power plants* — to determine the appropriate seismic ground motion parameters for a particular site;
(c) CSA N289.3-10, *Design procedures for seismic qualification of nuclear power plants* — to provide design requirements and methods
    (i) for determining the engineering representation of ground motion, ground response spectra, and floor response spectra for use in the design and seismic qualification of SSCs; and
    (ii) for performing seismic qualification of specified SSCs by analytical methods;
(d) CSA CAN3-N289.4-M86 (R2008), *Testing procedures for seismic qualification of CANDU nuclear power plants* — to provide design requirements and methods for seismic qualification of specific components and systems by testing methods; and
(e) CAN/CSA-N289.5-M91 (R2008), *Seismic instrumentation requirements for CANDU nuclear power plants* — to establish the requirements for seismic instrumentation and for seismic-related inspection of structures and systems before and after a seismic event.

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 Regulations. Thus, requirements additional to those specified in this Standard may be imposed by the CNSC.

This Standard was prepared by the Subcommittee on Design Procedures for Seismic Qualification of Nuclear Power Plants, under the jurisdiction of the Technical Committee on Seismic Design and the Strategic Steering Committee on Nuclear Standards, and has been formally approved by the Technical Committee.

May 2010

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.*

(4) *CSA Standards are subject to periodic review, and suggestions for their improvement will be referred to the appropriate committee.*

(5) *All enquiries regarding this Standard, including requests for interpretation, should be addressed to Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.*

Requests for interpretation should

(a) define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;

(b) provide an explanation of circumstances surrounding the actual field condition; and

(c) be phrased where possible to permit a specific "yes" or "no" answer.

Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization *and are published in CSA's periodical* Info Update*, which is available on the CSA Web site at www.csa.ca.*

N289.3-10
Design procedures for seismic qualification of nuclear power plants

1 Scope

1.1
This Standard specifies the requirements, criteria, and methods of analysis for
(a) determining the design response spectra and ground motion time-histories to be used in the analysis;
(b) establishing design criteria for SSCs, and supports that require seismic qualification; and
(c) performing seismic analyses, including the effects of the soil-structure-interaction.

1.2
This Standard applies to structures, systems, and components (SSCs) in nuclear power plants that require seismic qualification by analytical methods (see CSA N289.1). This Standard may also be applied to SSCs that might not require explicit seismic qualification as deemed appropriate by the owner/licensee or by authorities having jurisdiction.

1.3
This Standard may be applied, as appropriate, to other nuclear facilities under the jurisdiction of the *Nuclear Safety and Control Act*.

1.4
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.

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.

CSA (Canadian Standards Association)
CAN/CSA-A23.3-04 (R2010)
Design of concrete structures