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CSA N290.13:18

Environmental qualification of equipment for nuclear power plants

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D. Mendolia	CSA Group, Toronto, Ontario, Canada	*Project Manager*

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J. Vucetic	Canadian Nuclear Safety Commission (CNSC), Ottawa, Ontario, Canada	
D. Mendolia	CSA Group, Toronto, Ontario, Canada	*Project Manager*

Preface

This is the second edition of CSA N290.13, *Environmental qualification of equipment for nuclear power plants*. It supersedes the previous edition, published in 2005 under the title *Environmental qualification of equipment for CANDU nuclear power plants.*

Changes to this edition include the following:

a) The scope of the Standard has been updated to clarify the Standard's applicability to design basis accidents (DBAs) that create harsh environment conditions [i.e., exclusion of equipment in a mild environment from environmental qualification (EQ)].
b) The Standard has been updated to align with CNSC REGDOC-2.5.2, and to better align with current industry standards.
c) Further clarification regarding the application of EQ principles including condition-based qualification, combined qualification, and reassessment of qualified life have been provided.
d) The informative Annex A (Arrhenius methodology in predicting material aging) was removed.
e) The informative Annex B (Harsh environment conditions) has been updated to clarify the basis for typical screening criteria for a harsh environment and provide further guidance on implementation of these criteria, and is now located in Annex A.
f) The informative Annex C (Bibliography) was removed. A new informative Annex B [Equipment survivability assessments for design extension conditions (DEC)] has been included.

CSA N290.13 has been written as a general Standard for the establishment and maintenance of an EQ program for safety-related equipment in nuclear power plants (NPPs) that are within its scope. It provides generic requirements and methods for such qualification.

Safety-related equipment is qualified to ensure performance of its required safety functions under harsh environmental conditions that result from a DBA. Adherence to this Standard can result in improved public health and safety. The integrated performance of the process systems, instrumentation, and electrical systems limits the consequences of accidents.

A NPP safety analysis considers, in part, facilities and their safety system designs in terms of postulated service conditions. Inherent in each analysis are two presumptions that are evaluated. First, designs are such that equipment can actually perform designated safety functions in postulated harsh environments. Second, safety-related components are not degraded by in-service aging to the point where they cannot perform their designated safety functions when required.

Production testing, normal service testing, and surveillance might not be able to determine the equipment's vulnerability to failure resulting from inadequate design, in-service time, or environmental conditions, because of the special environmental stresses associated with some postulated service conditions. Under these circumstances, common-cause failure of redundant safety-related equipment might occur at a time when its safety function is required. It is the fundamental role of EQ to provide reasonable assurance that both design and manufacture permit the equipment to perform its required safety function(s) during normal and accident service conditions.

The CSA N-Series Standards provide 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 Group 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 might provide more specific direction for those requirements.

This Standard reflects the operating experience of the Canadian nuclear power industry.

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 was prepared by the Subcommittee on Environmental Qualification of Equipment for Nuclear Power Plants, 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:*
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   c) *wording of the proposed change; and*
   d) *rationale for the change.*

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0 Introduction

0.1 General

EQ is a process which establishes that safety-related equipment can perform its required safety function(s) during and after exposure to a harsh environment induced by a DBA.

Note: *Exposure to a harsh environment induced by a DBA might occur at any time during the equipment's service life.*

0.2 EQ program objectives

The objectives of an EQ program are to provide

a) design inputs necessary to establish safety functions, performance, normal service conditions, and DBA service conditions for safety-related equipment;
b) documented objective evidence verifying that equipment is capable of performing its safety function(s) under relevant DBA conditions, following a defined limit of age-related degradation during normal service, and identification of any installation requirements necessary to support the DBA performance;
c) controls and evidence to ensure that the equipment is installed in a manner that implements the EQ configuration and interface requirements; and
d) controls and evidence to ensure that qualification of the equipment is preserved throughout the design life of the plant.

1 Scope

1.1

This Standard specifies the requirements for an EQ program for nuclear power plants (NPPs) (see Figure 1). The EQ program comprises a set of planned and coordinated activities establishing auditable assurance that equipment will

a) perform safety functions in a harsh environment following the DBA(s) for which it is credited; and
b) meet or exceed its functional and performance requirements, taking into consideration the effects of normal service.

1.2

Equipment demonstrated to be in a mild environment after a DBA are not subject to the requirements of this Standard.

Note: *Post-DBA harsh environment conditions addressed by an EQ program are a subset of service conditions required to be addressed as part of overall equipment qualification. Service conditions can also include seismic, severe weather, external floods, electromagnetic interference and radio frequency interference, and fire. Equipment qualification to demonstrate performance in these conditions is outside of this Standard's scope. For further guidance on the equipment qualification process, see IEC/IEEE 60780-323.*

