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CSA Standards Nuclear Program

Juris Grava[1], Mary Cianchetti[2], Susan Oh[2]

[1] CANTECH Associates Limited, Burlington, Ontario, Canada
[2] Canadian Standards Association, Toronto, Ontario, Canada

grava@bmts.com , mary.cianchetti@csagroup.org , susan.oh@csagroup.org

Abstract

The objective of CSA Standards' nuclear program is to help promote a safe and reliable nuclear power industry in Canada and to exert a positive influence on the international nuclear power industry. While focusing on nuclear power plants, the program also encompasses other types of nuclear facilities such as uranium mines & mills and other class I nuclear facilities. This paper describes the CSA nuclear program including: program scope and structure, the use of CSA nuclear standards, the Standards development process and, recent program initiatives.

1. Introduction

CSA Standards is a not-for-profit membership-based association serving business, industry, government and consumers in Canada, and the global marketplace. CSA develops standards designed to enhance public safety and health, advance the quality of life, help to preserve the environment, and facilitate trade. Standards are developed through a process accredited by the Standards Council of Canada that brings together volunteers representing varied viewpoints and interests to achieve consensus. CSA standards are voluntary documents; only when a standard has been referenced by federal, local, state, provincial or municipal government, or by a regulatory authority, is compliance with the standard mandatory.

In Canada, the Canadian Nuclear Safety Commission (CNSC) regulates the nuclear industry. Their mandate is to protect the health, safety and security of Canadians and the environment; and to implement Canada's international commitments on the peaceful use of nuclear energy. The CNSC has issued extensive mandatory minimal requirements and regulations covering their respective areas of responsibility. CSA nuclear standards are intended to support and complement these regulations.

The CSA Nuclear Program was first established over 30 years ago in response to the needs of the Canadian nuclear industry and its regulator for a reliable process to develop vital standards to promote the safe and reliable operation of the nuclear power industry in Canada. The CSA Nuclear Program:

- Provides standards and forums to support licensing and regulation.

- Addresses knowledge management challenges within the industry by embedding key historical knowledge in documents and by providing junior technical personnel the opportunity to work with seasoned experts
- Provides an alternative to regulatory documents with consistent guidance to the Industry
- Provides a structure for interpretations of standards by an "expert panel"
- Meets identified stakeholder needs for standards on which to base future work;

Since launch, the program has published and maintained over 40 consensus standards across ten subject areas and continues to expand its suite of documents to support emerging industry needs. The program has since expanded to represent other nuclear sub-sectors including uranium mines & mills and other Class 1 nuclear facilities.

2. Program structure

2.1 Overview

CSA works with multi-stakeholder committees made up of industry, government, and general interest groups to develop and maintain over 40 nuclear-related standards and guidelines. More than 400 expert volunteers serve on over 30 committees to develop and maintain these important consensus-based standards, many of which are referenced in Licences and Licence Compliance Handbooks of operating plants across Canada.

The program structure consists of a governing Strategic Steering Committee, 10 Technical Committees, and over 30 Technical Subcommittees and working groups.

Under CSA's standards development methodology:

- CSA members develop standards content and CSA staff facilitates an accredited standards development process.

  CSA functions as a neutral third party, providing a structure and a forum for developing the Standard, but it is the committee members who write and update the standards.

- Decisions are made by consensus and balanced representation.

  CSA facilitates committees of volunteer experts to develop standards using a "balanced matrix" approach: each committee is structured to capitalize on the combined strengths and expertise of its members, with no single group dominating. The committee considers the views of all participants and develops the content of the standard by a consensus process that includes the principles of inclusive participation, and respect for diverse interest and transparency.

- Standards Committee volunteers are selected to represent various interest groups most likely to be affected by a standard, such as business & industry, regulatory bodies, science & academia, labour and consumer groups as applicable.

- Once published, standards are living documents, continually revised and refreshed to address changing requirements and emerging technologies. Each standard is reviewed at least every five years as part of CSA's process of continual improvement.

2.2 Nuclear Strategic Steering Committee (NSSC)

This governing committee carries a leadership role within the program, serving to provide program direction on content and quality by:

- Identifying program needs and priorities
- Assessing program effectiveness
- Establishing appropriate Technical Committees and work programs.

NSSC members comprise of senior industry and regulatory leaders (see Appendix 1 for a list of voting NSSC members).

2.3 Technical Committees (TCs)

TCs provide the expertise and guidance to develop the technical content of a standard. A TC has sole responsibility for approving the technical content of a standard. At the present time, there are 10 active TCs currently working in the program with over 40 standards published on a wide range of topics (see Appendix 2 for a list of CSA nuclear standards).

These TCs cover the following technology areas:

- Environmental Management
- Radioactive Waste Management
- Decommissioning of Nuclear Facilities
- Integrated Management Systems
- Pressure Retaining Components & Systems
- Periodic and In-Service Inspections
- Reactor Control Systems, Safety Systems & Instrumentation
- Fire Protection
- Structural Requirements / Safety Related Structures
- Seismic Design

2.4 Technical Subcommittees (TSCs)

Where a TC is responsible for multiple standards, or it deems the creation of a seed document preferable, it can establish a TSC of subject matter experts to draft all or a significant portion of the initial standard. TSCs provide guidance to the TC and but do not have approval authority over the final document.

3. Use of nuclear standards

Standards developed through the CSA Nuclear Program represent the technical requirements for compliance with regulation, a clear testament to the strength of the CSA standards development process. These standards are referenced in Licences and Licence Compliance Handbooks of operating plants across Canada. A complete listing of published and upcoming CSA nuclear standards can be found in Appendix 2.

In addition to developing standards, the Program also offers interpretation of the intent of its standards. While it is always CSA's goal to use language in its standards that is sufficiently clear, there are times when CSA receives a request for the interpretation of a specific clause or clauses of a standard to clarify the intent of the committee. An interpretation provides a written clarification of the meaning of a specific provision of a standard that is made available to the public via CSA's website and retained for historical record. Interpretations are formally approved by the responsible TC, ensuring a balanced and consensus-based outcome. CSA's Interpretation Process offers users a way to obtain technically competent interpretations of a standard in a transparent manner.

4. Development process

4.1 Stages

Within CSA's Nuclear Program, each new standard, new edition or amendment of an existing Standard goes through a similar process:

- A project proposal is reviewed and authorized by the NSSC. The project proposal is a scope document that outlines the need/drivers for the project, the expected approach to alignment with applicable international standards, and the resources needed to complete the project (e.g., cost, schedule).
- Public notice of intent to proceed with the project is published on CSA's website
- A TC is assigned the project
- The TC or TSC (facilitated by CSA staff) develops the draft.
- The draft is released for a 60-day public review and comment period; all comments are reviewed and dispositioned by the TC.
- The TC approves the technical content of the draft. Negative ballots are resolved.
- CSA staff conducts a final edit and review to verify conformity with applicable editorial and procedural requirements.
- The approved standard is published in both English and French.
- The standard is maintained with the objective of keeping it up to date and technically valid. This may include the publication of amendments, the interpretation of a standard or clause, and the systematic review of all standards (to ensure standards are current each published standard must be reaffirmed at least once every 5 years; or the standard is withdrawn).

The high degree of process transparency and predictability is seen by stakeholders as a key strength of the CSA standards development framework.

4.2 Speed

The average cycle time to produce a CSA nuclear standard from project approval to publication in English is 20-24 months. The nuclear program continues to strive to streamline the CSA standards development process and remove non-value added steps. Where there is an identified need and stakeholder support, CSA has been able to reduce this cycle-time significantly. As an example, the Safe Operating Envelope Standard, CSA N290.15[1], was successfully completed within 7 months.

4.3 Membership

Being at the table will give you an opportunity to represent your stakeholder interests within the standards development process, as well as the chance to network with other professionals and peers.

Your organization will benefit from membership by:

- Having a voice in the standards that are used in regulation
- Building relationships with other industry and public stakeholders
- Sharing operating experience and best practices.

If you are not a member you can get involved:

- Submit comments on draft standards documents released for Public Review.
- Request interpretations on one of our published documents and receive written clarification of the meaning of a specific provision of a standard.
- Subscribe to the CSA mailing list for email updates

5. Recent program initiatives

5.1 Nuclear renaissance

The nuclear renaissance has created a need to support station refurbishments across Canada, as well as plans for new builds in the province of Ontario. As a result, a large number of new standards, new editions and amendments have been published over the past five years. During this updating process there has been a focus on:

- Moving to new terminology as supported by IAEA's NS-R-1[2] and the CNSC's RD-337[3] documents.

  In order to keep inline with new regulatory requirements and international practice, the CSA Nuclear Program is proactively incorporating consistent and internationally aligned terminology in its documents.

  CSA staff maintains a database of definitions used within the CSA nuclear suite, the Canadian regulatory framework, and international IAEA and ISO nuclear documents. The use of a common definition database ensures that new standards and new editions are able to pick up and use these terms consistently.

- Producing technology-neutral standards where applicable.

  When new-build license applications indicated the possibility of non-CANDU technologies in Canada, CSA began to shift their nuclear documents to a technology-neutral approach. This approach involved: capturing CANDU requirements, benchmarking other international standards; and separating CANDU specific requirements from overall safety goals.

  In Canada all power reactors are of the CANDU design. Many CSA standards have been written for specific CANDU components such as pressure tubes or vacuum containment. Standard project plans are now required to define if they need to be technology neutral and

how they will meet this requirement. To not lose CANDU specific system requirements and the knowledge base that goes along with them, CANDU specific appendices or sections are identified as such. The biggest challenge to being technology neutral is to have access to subject matter experts of other reactor types.

5.2 Approach to Fukushima Daiichi event

In parallel with regulatory and industry response, the CSA Nuclear Program has initiated an action plan to address the Fukushima Daiichi event. Assessment of the CSA Nuclear Program has proceeded with the following guiding principles

- Beliefs and values on which to base the approach
  - CSA standards must be based on sound technical assessment
  - Direction must be aligned with regulatory direction
- Input to CSA programming
  - Factual account of the event
  - Regulatory perspective
- Initial response
  - Review CSA standards against initial CNSC, WANO action notices and industry response to identify any need for change
- A Second Review and then ongoing review
  - Once root cause report is available and new information comes to light.

To date, a need for improvements in defining emergency response capability, event definition, severe accident management guidelines, post accident monitoring, hydrogen gas management, and irradiated fuel bay instrumentation & cooling has been identified by program members.

6. Conclusion

The CSA Nuclear Program:

- Compliments policy and regulations by providing the standard building blocks within regulations.

  Regulations define ‘what’ is needed to be done, and are supported by documents that clarify ‘how’; in the form of either Regulatory Documents OR Industry standards.
- Offers a cost-effective and transparent process to meet current and emerging industry standards needs.
- Captures minimum requirements and best practices for industry while promoting consistency of practice and interpretation of requirements.
- Ensures that equal weight is given to all stakeholders including government, industry, and general interest groups.

7. Acknowledgments

The authors gratefully acknowledge the continuing contributions of the members of the NSSC, TC's and TSC's over many years in creating and maintaining CSA nuclear standards. The assigned CSA Project Managers have provided excellent support since the inception of this work, which is much appreciated. The time and expenses of the majority of the participants were funded by the organizations they represent, and the remaining costs were covered by the CSA through the organizations that voluntarily contribute funding.

8. Nomenclature

Class I nuclear facilities — a Class IA or Class IB facility defined as follows:

Class IA nuclear facility —

(a) a nuclear fission or fusion reactor, or subcritical nuclear assembly; or
(b) a vehicle that is equipped with a nuclear reactor.

Class IB nuclear facility —

(a) a facility that includes a particle accelerator other than a particle accelerator described in paragraphs (d) and (e) of the definition "Class II prescribed equipment" in section 1 of the *Class II Nuclear Facilities and Prescribed Equipment Regulations*[(4)];
(b) a plant for the processing, reprocessing, or separation of an isotope of uranium, thorium, or plutonium;
(c) a plant for the manufacture of a product from uranium, thorium, or plutonium;
(d) a plant other than a Class II nuclear facility as defined in section 1 of the *Class II Nuclear Facilities and Prescribed Equipment Regulations*[(4)], for the processing or use, in a quantity greater than 1015 Bq per calendar year, of nuclear substances other than uranium, thorium, or plutonium;
(e) a facility for the disposal of a nuclear substance generated at another nuclear facility; or
(f) a facility defined in paragraph 19(a) or (b) of the *General Nuclear Safety and Control Regulations*[(4)] as
    (i) a facility for the management, storage, or disposal of waste containing radioactive nuclear substances at which the resident inventory of radioactive nuclear substances contained in the waste is 1015 Bq or more; or
    (ii) a plant for the production of deuterium or deuterium compounds using hydrogen sulphide.

9. References

[1] CSA N290.15, Requirements for the safe operating envelope of nuclear power plants
[2] IAEA Safety Standards Series No. NS-R-1, Safety of Nuclear Power Plants: Design Safety Requirements

[3] CNSC RD-337, Design of New Nuclear Power Plants
[4] *Government of Canada, Nuclear Safety and Control Act*, SC 1997, c. 9
General Nuclear Safety and Control Regulations. 2000. (SOR/2000-202)
Class I Nuclear Facilities Regulations. 2000. (SOR/2000-204)
Class II Nuclear Facilities and Prescribed Equipment Regulations. 2000. (SOR/2000-205)

Appendix 1

CSA Nuclear Program - Nuclear Strategic Steering Committee, voting membership (2012)

Eben Creaser	Province of New Brunswick Dept of Public Safety
Mark Dallaire	Canadian Nuclear Safety Commission (CNSC)
Patrice Desbiens	Hydro-Quebec Centrale nucléaire Gentilly-2
Frank DiDomizio	GE-Hitachi Nuclear Energy Canada Inc
William Elliott	Ontario Power Generation Inc
John Froats	University of Ontario Institute of Technology (UOIT)
Glenn Greenlaw	NB Power Nuclear Corporation
Cedric Jobe	Ontario Ministry of Energy
Heather Kleb	Canadian Nuclear Association
Madiha Kotb	Régie du bâtiment du Québec
John Mackinnon	AMEC NSS
Husain Mehdi	Kinectrics Inc.
Jeff Millman	Babcock & Wilcox Canada Ltd
Robert Morrison	CANDU Owners Group Inc.
Frank Saunders	Bruce Power Inc.
Colette Taylor	Atomic Energy of Canada Limited (AECL)
Cathy Turylo	Technical Standards & Safety Authority (TSSA)
Tammy Van Lambalgen	AREVA Resources Canada Inc
Liam Mooney	Cameco Corporation
Frank Yee	Candu Energy Inc

Appendix 2

CSA Nuclear Program - suite of standards

CSA nuclear standards can be purchased through the CSA Online Store at http://shop.csa.ca

N285-A, Pressure retaining components and systems

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

N285-B, Periodic and in-service inspections

N285.4 Periodic inspection of CANDU nuclear power plant components

N285.5 Periodic inspection of CANDU nuclear power plant containment components
N285.7* Periodic inspection of nuclear power plant pressurized conventional systems
N285.8 Technical requirements for in-service evaluation of zirconium alloy pressure tubes in CANDU reactors

N286, Integrated management systems

N286 Management system requirements for nuclear facilities
N286.7 Quality assurance of analytical, scientific and design computer programs for nuclear power plants
N286.7.1 Guideline for the application of N286.7-99, Quality assurance of analytical, scientific, and design computer programs for nuclear power plants

N287, Structural requirements

N287.1 General requirements for concrete containment structures for CANDU nuclear power plants
N287.2 Material requirements for concrete containment structures for CANDU nuclear power plants
N287.3 Design requirements for concrete containment structures for CANDU nuclear power plants
N287.4 Construction, fabrication, and installation requirements for concrete containment structures for CANDU nuclear power plants
N287.5 Examination and testing requirements for concrete containment structures for nuclear power plants
N287.6 Pre-operational proof and leakage rate testing requirements for concrete containment structures for nuclear power plants
N287.7* In-service examination and testing requirements for concrete containment structures for CANDU nuclear power plants

N288, Environmental management

N288.1 Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities
N288.2 Guidelines for calculating radiation doses to the public from a release of airborne radioactive material under hypothetical accident conditions in nuclear reactors
N288.3.4* Performance testing of air-cleaning systems at nuclear facilities
N288.4 Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills
N288.5 Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills
N288.6* Environmental risk assessment for nuclear facilities

N289, Seismic Design

N289.1 General requirements for seismic design and qualification of CANDU nuclear power plants
N289.2 Ground motion determination for seismic qualification of nuclear power plants
N289.3 Design procedures for seismic qualification of nuclear power plants

N289.4 Testing procedures for seismic qualification of CANDU nuclear power plants
N289.5 Seismic instrumentation requirements for CANDU nuclear power plants

N290, Reactor control systems, safety systems, and instrumentation

N290.0 General requirements for safety systems of nuclear power plants
N290.1 Requirements for the shutdown systems of CANDU nuclear power plants
N290.2 Requirements for emergency core cooling systems of nuclear power plants
N290.3 Requirements for the containment system of nuclear power plants
N290.4 Requirements for reactor control systems of nuclear power plants
N290.5 Requirements for electrical power and instrument air systems of CANDU nuclear power plants
N290.6 Requirements for monitoring and display of nuclear power plant safety functions in the event of an accident
N290.11* Requirements for the reactor heat removal capability during maintenance outage of nuclear power plants
N290.13 Environmental qualification of equipment for CANDU nuclear power plants
N290.14 Qualification of pre-developed software for use in safety-related instrumentation and control applications in nuclear power plants
N290.15 Requirements for the safe operating envelope of nuclear power plants

N291, Safety related structures

N291 Requirements for safety-related structures for CANDU nuclear power plants

N292, Radioactive waste management

N292.2 Interim dry storage of irradiated fuel
N292.3 Management of low- and intermediate-level radioactive waste
N292.5 Guideline for the exemption or clearance from regulatory control of materials that contain, or potentially contain, nuclear substances

N293 and N393, Fire protection

N293 Fire protection for CANDU nuclear power plants
N393* Fire protection for facilities that process, handle or store nuclear material

N294, Decommissioning

N294 Decommissioning of facilities containing nuclear substances

* new standard under development