FORM-14159 R000*

Periodic Safety Review - Final Document Review Traveler

Bruce Power

Bruce Power Document #:	Revision:	Information Classification	Usage Classification
NK21-SFR-09701-00007	R000	Internal Use Only	Information
Bruce Power Document Title: Safety Factor 7 – Hazard Analysis			
Bruce Power Contract/Purchase Order: 00193829	Bruce Power Project #: 38180		
Supplier's Name: CANDESCO	Supplier Document #: K-421231-00017	Revision: R00	
Supplier Document Title: Safety Factor 7 – Hazard Analysis			

Accepted for use at Bruce Power by:	**Signature:**	**Date**
Name: Gary Newman Title: Chief Engineer & Sr. Vice President, Engineering		27AUG2015.

Acceptance of this document does not relieve the Supplier of responsibility for any errors or omissions

*Associated with BP-PROC-01024, Periodic Safety Reviews

Periodic Safety Review - Final Document Review Traveler

Sheet # 2 of 5

Bruce Power Document #:	NK21-SFR-09701-00007	Rev #: R000	**Information Classification:** Internal Use Only	**Usage Classification:** Information
Bruce Power Document Title:	Safety Factor 7 – Hazard Analysis	Suppliers Name:	CANDESCO	
Bruce Power Contract/ Purchase Order:	00193829	Supplier Document Title:	Safety Factor 7 – Hazard Analysis	
Bruce Power Project #:	38180	Supplier Document:	K-421231-00017	Rev #: R00

Reviewed By:

Name	Title	Department	Signature	Date
Ken Chuong	Sr. Technical Specialist	Nuclear Safety Analysis and Support		August 10, 2015
Joan Higgs	Technical Advisor, Engineering	Nuclear Safety Analysis and Support		August 10, 2015
Rob McLean	Sr. Technical Engineer	Nuclear Safety Analysis and Support	for	August 10, 2015

Recommended for Use By:

Name	Title	Department	Signature	Date
Phil Hunt	Division Manager	Reactor Safety Engineering		19 Aug 2015

Periodic Safety Review - Final Document Review Traveler

Sheet # 3 of 5

Bruce Power Document #:	NK21-SFR-09701-00007	Rev #: R000	**Information Classification:** Internal Use Only	**Usage Classification:** Information	
Bruce Power Document Title:	Safety Factor 7 – Hazard Analysis	Suppliers Name:	CANDESCO		
Bruce Power Contract/ Purchase Order:	00193829	Supplier Document Title:	Safety Factor 7 – Hazard Analysis		
Bruce Power Project #:	38180	Supplier Document:	K-421231-00017	Rev #: R00	

Reviewed By:

Name	Title	Department	Signature	Date
Susan Brissette	Dept. Manager	Management Systems	SBrissette	31 JUL 15

Recommended for Use By:

Name	Title	Department	Signature	Date
Susan Brissette	Dept. Manager	Management Systems	SBrissette	31 JUL 15

Periodic Safety Review - Final Document Review Traveler

Sheet # 4 of 5

Bruce Power Document #:	NK21-SFR-09701-00007	Rev #: R000	**Information Classification:** Internal Use Only	**Usage Classification:** Information
Bruce Power Document Title:	Safety Factor 7 – Hazard Analysis	Suppliers Name:	CANDESCO	
Bruce Power Contract/ Purchase Order:	00193829	Supplier Document Title:	Safety Factor 7 – Hazard Analysis	
Bruce Power Project #:	38180	Supplier Document:	K-421231-00017	Rev #: R000

Reviewed By:

Name	Title	Department	Signature	Date
Scott Ellis	Section Manager	Probabilistic Safety Analysis		21-Aug 2015
Ed Arciszewski	Technical Advisor, Engineering	Probabilistic Safety Analysis		21 Aug 2015

Recommended for Use By:

Name	Title	Department	Signature	Date
Phil Hunt	Division Manager	Reactor Safety Engineering		21 Aug 2015

Periodic Safety Review - Final Document Review Traveler

Sheet # 5 of 5

Bruce Power Document #:	NK21-SFR-09701-00007	Rev #: R000	**Information Classification:** Internal Use Only	**Usage Classification:** Information	
Bruce Power Document Title:	Safety Factor 7 – Hazard Analysis	Suppliers Name:	CANDESCO		
Bruce Power Contract/ Purchase Order:	00193829	Supplier Document Title:	Safety Factor 7 – Hazard Analysis		
Bruce Power Project #:	38180	Supplier Document:	K-421231-00017	Rev #: R00	

Reviewed By:

Name	Title	Department	Signature	Date
Cheryl Smith	Sr. Technical Officer	Environment Programs	Cheryl Smith	28 Jul 2015

Recommended for Use By:

Name	Title	Department	Signature	Date
Francis Chua	Dept. Manager	Environment Management	F. Chua	18 AUG 2015

Periodic Safety Review - Final Document Review Traveler

Sheet # _____ of _____

Bruce Power Document #:		Rev #:	**Information Classification:** Internal Use Only	**Usage Classification:** Information
Bruce Power Document Title:		Suppliers Name:		
Bruce Power Contract/ Purchase Order:		Supplier Document Title:		
Bruce Power Project #:		Supplier Document:		Rev #:

Reviewed By:

Name	Title	Department	Signature	Date

Recommended for Use by:

Name	Title	Department	Signature	Date

Periodic Safety Review - Final Document Review Traveler

Sheet # _____ of _____

Bruce Power Document #:		Rev #:	**Information Classification:** Internal Use Only	**Usage Classification:** Information
Bruce Power Document Title:		Suppliers Name:		
Bruce Power Contract/ Purchase Order:		Supplier Document Title:		
Bruce Power Project #:		Supplier Document:		Rev #:

Reviewed By:

Name	Title	Department	Signature	Date

Recommended for Use By:

Name	Title	Department	Signature	Date

candesco
Division of Kinectrics Inc.

Title: Safety Factor Report 7 - Hazard Analysis

File: K-421231-00017-R00

NK21-SFR-09701-00007

A Report Submitted to Bruce Power

June 30, 2015

Issue R00D0	**Reason for Issue:** For first internal Candesco review				
	Author: M. Gold	Verifier:	Reviewer: G. Archinoff T. Kapaklili	Approver:	Date: Nov 26, 2014
Issue R00D1	**Reason for Issue:** For harmonization, which incorporates internal Candesco review comments				
	Author: M. Gold	Verifier:	Reviewer: G. Archinoff T. Kapaklili	Approver:	Date: Jan 20, 2015
Issue R00D2	**Reason for Issue:** For final internal Candesco review				
	Author: M. Gold	Verifier:	Reviewer: G. Archinoff L. Watt	Approver:	Date: Feb 20, 2015
Issue R00D3	**Reason for Issue:** Issued to Bruce Power for review				
	Author: M. Gold	Verifier: G. Buckley	Reviewer: G. Archinoff L. Watt	Approver:	Date: March 6, 2015

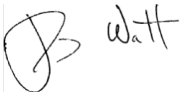
Issue R00D4	**Reason for Issue:** Incorporates changes from Bruce Power review				
	Author: M. Gold	Verifier: G. Aldev	Reviewer: G. Archinoff L. Watt	Approver:	Date: June 19, 2015
Issue R00	**Reason for Issue:** For use				
	Author: M. Gold 	Verifier: G. Aldev  C. Stallman 	Reviewer: G. Archinoff  L. Watt 	Approver: L. Watt 	Date: June 30, 2015
Document Classification: Report			Security Classification: Client Proprietary		

Table of Contents

List of Tables

Acronyms and Abbreviations

ASB	Ancillary Services Building
BP	Bruce Power
CANDU	Canada Deuterium Uranium
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
EA	Environmental Assessment
EFPH	Equivalent Full Power Hours
EQ	Environmental Qualification
FASAs	Focus Area Self Assessment(s)
IAEA	International Atomic Energy Agency
ISR	Integrated Safety Review
LCH	Licence Conditions Handbook
LTEP	Long Term Energy Plan
MCR	Major Component Replacement
NPP	Nuclear Power Plant
NSCA	Nuclear Safety and Control Act
OFI	Opportunities for Improvement
PIEs	Postulated Initiating Event(s)
PRA	Probabilistic Risk Assessment
PROL	Power Reactor Operating Licence
PSA	Probabilistic Safety Assessment (synonymous with PRA)
PSR	Periodic Safety Review
QA	Quality Assurance
SAMGs	Severe Accident Management Guidelines
SBR	Safety Basis Report
SFR	Safety Factor Report
SMA	Seismic Margin Assessment
SSCs	Structures, Systems, and Components

1. Objective and Description

Bruce Power (BP), as an essential part of its operating strategy, is planning to continue operation of Units 3 and 4 as part of its contribution to the Long Term Energy Plan (LTEP) (http://www.energy.gov.on.ca/en/ltep/). Bruce Power has developed plant life integration management plans in support of operation to 247,000 Equivalent Full Power Hours (EFPH). A more intensive Asset Management program is under development, which includes a Major Component Replacement (MCR) approach to replace pressure tubes, feeders and steam generators, so that the units are maintained in a fit for service state over their lifetime. However, due to the unusually long outage and de-fuelled state during pressure tube replacement, there is an opportunity to conduct other work, and some component replacements that could not be done reasonably in a maintenance outage will be scheduled concurrently.

To support the definition and timing of practicable opportunities for enhancing the safety of Units 3 and 4, and the ongoing operation of Units 1 and 2, which have already been refurbished, Bruce Power is conducting a station-wide review of safety for Units 0A and 1-4, to be termed an Integrated Safety Review (ISR) [1]. This ISR supersedes the Bruce A portion of the interim Periodic Safety Review (PSR) that was conducted for the ongoing operation of the Bruce A and B units until 2019 [2]. This ISR is conducted in accordance with the Bruce A ISR Basis Document [1], which states that the ISR will meet or exceed the international guidelines given in International Atomic Energy Agency (IAEA) Guide SSG-25, Periodic Safety Review for Nuclear Power Plants [3]. The ISR envelops the guidelines in Canadian Nuclear Safety Commission (CNSC) Regulatory Document RD-360 [4], Life Extension for Nuclear Power Plants, with the exception of those related to the Environmental Assessment (EA), which has already been completed for Bruce A [5][1].

1.1. Objective

The overall objective of the Bruce A ISR is to conduct a review of Bruce A against modern codes and standards and international safety expectations and provide input to a practicable set of improvements to be conducted during the Major Component Replacement in Units 3 and 4, and during asset management activities to support ongoing operation of all four units, including U0A, that will enhance safety to support long term operation. The look-ahead period will be longer than that in the interim PSR performed for Units 1-8 [2]. It will cover a 10-year period, since there is an expectation that a PSR will be performed on approximately a 10-year cycle, given that all units are expected to be operated well into the future. Nuclear Safety is a primary consideration for Bruce Power and the management system must support the enhancement and improvement of safety culture and the achievement of high levels of safety, as well as reliable and economic performance.

[1] RD-360 [4] was superseded by CNSC REGDOC-2.3.3 [6] in April 2015. CNSC REGDOC-2.3.3 was in draft at the time that the ISR Basis Document [1] was prepared. The draft version of CNSC REGDOC-2.3.3 stated that it was consistent with IAEA SSG-25, and the assessments in the Safety Factor Reports were performed on that basis. The issued version of CNSC REGDOC-2.3.3 also states that it is consistent with SSG-25, and therefore it is considered that the ISR envelops the guidelines in CNSC REGDOC-2.3.3.

The specific objective of the review of this Safety Factor is to determine the adequacy of protection of the nuclear power plant against internal and external hazards with account taken of the actual plant design, actual site characteristics, the actual condition of Systems/Structures /Components and their predicted state at the end of the period covered by the ISR, and current analytical methods, safety standards and knowledge.

1.2. Description

The review is conducted in accordance with the Bruce A ISR Basis Document [1], which states that the review tasks are as follows:

1. For each internal or external hazard identified, include the adequacy of the protection, with account taken of the following:
    a. The credible magnitude and associated frequency of occurrence of the hazard;
    b. Current safety standards;
    c. Current understanding of environmental effects;
    d. The capability of the plant to withstand the hazard as claimed in the safety case, based on its current condition and with allowance given to predicted ageing degradation;
    e. The appropriateness of procedures to cover operator actions claimed to prevent or mitigate the hazard.
2. Check list of internal and external hazards for completeness.
    a. The following is a representative list of internal hazards that may affect plant safety (additional site specific internal hazards will be included under this Safety Factor if appropriate):
        i. Fire (including measures for prevention, detection and suppression of fire);
        ii. Flooding;
        iii. Pipe whip;
        iv. Missiles and drops of heavy loads;
        v. Steam release;
        vi. Hot gas release;
        vii. Cold gas release;
        viii. Deluge and spray;
        ix. Explosion;
        x. Electromagnetic or radio frequency interference;
        xi. Toxic and/or corrosive liquids and gases;
        xii. Vibration;
        xiii. Subsidence;
        xiv. High humidity;
        xv. Structural collapse;
        xvi. Loss of internal and external services (cooling water, electricity, etc.);
        xvii. High voltage transients; and
        xviii. Loss or low capacity of air conditioning (which may lead to high temperatures).

b. The following is a list of representative external hazards that may affect plant safety (additional site specific external hazards will be included under this Safety Factor if appropriate):

i. Floods, including tsunamis;
ii. High winds, including tornadoes;
iii. Fire;
iv. Meteorological hazards (extreme temperatures, extreme weather conditions, high humidity, drought, snow, buildup of ice);
v. Sun storm;
vi. Toxic and/or corrosive liquids and gases, other contamination in the air intake (for example, industrial contaminants, volcanic ash);
vii. Hydrogeological and hydrological hazards (extreme groundwater levels, seiches[2]);
viii. Seismic hazards;
ix. Volcano hazards;
x. Aircraft crashes, external missiles;
xi. Explosion;
xii. Biological fouling;
xiii. Lightning strike;
xiv. Electromagnetic or radio frequency interference;
xv. Vibration;
xvi. Traffic; and
xvii. Loss of internal and external services (cooling water, electricity, etc).

2. Methodology of Review

As discussed in the Bruce A ISR Basis Document [1], the methodology for an ISR should include making use of safety reviews that have already been performed for other reasons. Accordingly, the Bruce A ISR makes use of previous reviews that were conducted for the following purposes:

- Return to service of Bruce Units 3 and 4 (circa 2001) [7];
- Life extension of Bruce Units 1 and 2 (circa 2006) [8] [9];
- Proposed refurbishments of Bruce Units 3 and 4 (circa 2008) [10] [11] [12]; and
- Safety Basis Report (SBR) and Periodic Safety Review (PSR) for Bruce Units 1 to 8 (2013) [2].

These reviews covered many, if not all, of the same Safety Factors that are reviewed in the current ISR. A full chronology of Bruce Power safety reviews is provided in Appendix F of [13].

The Bruce A ISR Safety Factor review process comprises the following steps:

[2] A seiche is an extreme oscillation in water level.

1. **Interpret and confirm review tasks:** As a first step in the Safety Factor review, the Safety Factor Report author(s) confirm the review tasks identified in the ISR Basis and repeated in Section 1.2 to ensure a common understanding of the intent and scope of each task. In some cases, this may lead to elaboration of the review tasks to ensure that the focus is precise and specific. Any changes to the review tasks are identified in Section 5 of the Safety Factor Report (SFR) and a rationale provided.
2. **Confirm the codes and standards to be considered for assessment:** The Safety Factor Report author(s) validates the list of codes and standards presented in the ISR Basis Document against the defined review tasks to ensure that the assessment of each standard will yield sufficient information to complete the review tasks. Additional codes and standards are added if deemed necessary. If no standard can be found that covers the review task, the assessor may have to identify criteria on which the assessment of the review task will be based. The final list of codes and standards considered for this Safety Factor is provided in Section 3.
3. **Determine the type and scope of assessment to be performed:** This step involves confirming or modifying the assessment type for each of the codes and standards and guidance documents identified for consideration. The ISR Basis Document provides an initial assignment for the assessment type, selecting one of the following review types:
   - Programmatic Clause-by-Clause Assessments;
   - Plant Clause-by-Clause Assessments;
   - High-Level Programmatic Assessments;
   - High-Level Plant Assessments;
   - Code-to-Code Assessments; or
   - Confirm Validity of Previous Assessment.

   The final assessment types are identified in Section 3, along with the rationale for any changes relative to the assignment types listed in the ISR Basis Document.
4. **Perform gap assessment against codes and standards:** This step comprises the actual assessment of the Bruce Power programs and the Bruce A plant against the identified codes and standards. In general, this involves determining from available design or programmatic documentation whether the plant's design or programs meet the provisions of the specific clause of the standard or of some other criterion, such as a summary of related clauses. Each individual deviation from the provisions of codes and standards is referred to as a Safety Factor "micro-gap". The assessments, performed in Appendix A and Appendix B, include assessor's arguments conveying reasons why the clause is considered to be met or not met, while citing appropriate references that support this contention.
5. **Assess alignment with the provisions of the review tasks:** The results of the gap assessment against codes and standards are interpreted in the context of the review tasks of the Safety Factor. To this end, each assessment, whether clause-by-clause, high-level or code-to-code, is assigned to one or more of the review tasks (Section 5). Assessment against the provision of the review task involves formulating a summary assessment of the degree to which the plant or program meets the objective and provisions of the particular

review task. This assessment may involve consolidation and interpretation of the various compliance assessments to arrive at a single compliance indicator for the objective of the review task as a whole.

6. **Perform program assessments:** The most pertinent self-assessments, audits and regulatory evaluations are assessed, and performance indicators relevant to the Safety Factor identified. The former illustrates that Bruce Power has a comprehensive process of reviewing compliance with Bruce Power processes, identifying gaps, committing to corrective actions, and following up to confirm completion and effectiveness of these actions. The latter demonstrates that there is a metric by which Bruce Power assesses the effectiveness of the programs relevant to the Safety Factor in Section 7. Taken as a whole, these provide a cross section, intended to demonstrate that the processes associated with this Safety Factor are implemented effectively (individual findings notwithstanding). Thus, program effectiveness, if not demonstrated explicitly in the review task assessments in Step 5, can be inferred if Step 5 shows that Bruce Power processes meet the Safety Factor requirements and if this step shows there are ongoing processes to ensure compliance with Bruce Power processes.
7. **Identification of findings:** This step involves the consolidation of the findings of the assessment against codes and standards and the results of executing the review tasks into a number of definitive statements regarding positive and negative findings of the assessment of the Safety Factor. Positive findings or strengths are only identified if there is clear evidence that the Bruce A plant or programs exceed compliance with the provision of codes and standards or review task objectives. Each individual negative finding or deviation is designated as a Safety Factor micro-gap for tracking purposes. Identical or similar micro-gaps are consolidated into comprehensive statements that describe the deviation known as Safety Factor macro-gaps, which are listed in Section 8 of the Safety Factor Reports, as applicable.

3. Applicable Codes and Standards

This section lists the applicable regulatory requirements, codes and standards considered in the review of this Safety Factor. The list also includes any new codes or standards that came into effect after the completion of the 2013 PSR, as well as those that supersede codes or standards previously assessed. Regulatory codes and standards issued after the code effective date of August 31, 2014 were not part of the detailed review.

3.1. Acts and Regulations

The *Nuclear Safety and Control Act* (NSCA) [14] establishes the Canadian Nuclear Safety Commission and its authority to regulate nuclear activities in Canada. The NSCA has been amended on July 3, 2013 to provide the CNSC with the authority to establish an administrative monetary penalty system. The Administrative Monetary Penalties Regulations were introduced in 2013, and set out the list of violations that are subject to administrative monetary penalties, as well as the method and criteria for penalties administration. However, these changes do not impact this Safety Factor. Furthermore, following the Fukushima nuclear events of March 2011,

the Fukushima Omnibus Amendment Project was undertaken and completed in 2012, and resulted in amendments to regulatory documents to reflect lessons learned from these events. Bruce Power has a process to ensure compliance with the NSCA [14] and its Regulations. Therefore, the NSCA and Regulations were not considered further in this review.

3.2. Power Reactor Operating Licence

The list of codes and standards related to ageing that are referenced in the Bruce Power Reactor Operating Licence (PROL) [15] and Licence Conditions Handbook (LCH) [16] noted in Table C-1 of the ISR Basis Document [1] are identified in Table 4[3]. The edition dates referenced in the third column of the table are the modern versions used for comparison.

Table 1: Codes, Standards, and Regulatory Documents Referenced in Bruce A PROL and LCH

Document Number	Document Title	Modern Version used for ISR Comparison	Type of Review
CNSC RD-360 (2008)	Life Extension Of Nuclear Power Plants	CNSC RD-360 (2008) [4]	NR
CNSC RD-310 (2008) [19]	Safety Analysis For Nuclear Power Plants	CNSC REGDOC-2.4.1 [20]	CBC
CSA N286-05 [21]	Management System Requirements for Nuclear Facilities	CSA N286-12 [22]	NR
CSA N286.7-99	Quality Assurance of Analytical, Scientific And Design Computer Programs for Nuclear Power Plants	CSA N286.7-99 (R2012) [23]	CV
CSA N290.13-05	Environmental Qualification of Equipment for CANDU Nuclear Power Plants	CSA N290.13-05 (R2010) [24]	CV
CSA N290.15-10	Requirements for the Safe Operating Envelope of Nuclear Power Plants	CSA N290.15-10 (2010) [25]	NR

[3] PROL 18.00/2020 [17] and LCH-BNGS-R000 [18] came into effect on June 1, 2015. However, PROL 15.00/2015 [15] and LCH-BNGSA-R8 [16] are the versions referred to in this ISR, as these were in force when the assessments in the Safety Factor Reports were performed.

Document Number	Document Title	Modern Version used for ISR Comparison	Type of Review
CSA N293-07	Fire Protection For CANDU Nuclear Power Plants	CSA N293-12 [26]	CTC
Assessment type: Clause-by-Clause (CBC); Code-to-Code (CTC); High Level (HL); No Assessment Required (NR); Confirm Validity of Previous Assessments (CV)			

CNSC RD-360: This ISR is being conducted as part of ongoing operation for Units 1 and 2 and to support Major Component Replacement of Units 3 and 4, so it also envelops the guidelines in RD-360, Life Extension for Nuclear Power Plants, issued February 2008. Therefore, RD-360 [4] *de facto* continues to provide guidance on how this review should be conducted. However, RD-360 [4] was superseded by CNSC REGDOC-2.3.3 [6] in April 2015, which was in draft at the time that the ISR Basis Document [1] was prepared. The draft version of CNSC REGDOC-2.3.3 stated that it was consistent with SSG-25, and the assessments in the Safety Factor Reports were performed on that basis. The issued version of CNSC REGDOC-2.3.3 also states that it is consistent with SSG-25, and therefore it is considered that the ISR envelops the guidelines in CNSC REGDOC-2.3.3.

CNSC REGDOC-2.4.1: Table C-1 of [1] calls for a code-to-code assessment of differences between CNSC RD-310 [19] and CNSC REGDOC-2.4.1 [20], followed by a clause-by-clause assessment against only those CNSC REGDOC-2.4.1 clauses without corresponding equivalent RD-310 clauses. It was decided to instead do a clause-by-clause assessment against all clauses of CNSC REGDOC-2.4.1 with relevance to this Safety Factor. Clauses of CNSC REGDOC-2.4.1 [20] that are relevant to this Safety Factor are assessed as part of this Safety Factor and the results are presented in Appendix B (B.1).

CSA N286-12: Table C-1 of the ISR Basis [1] calls for a code-to-code review against Canadian Standards Association (CSA) standard CSA N286-05, although not for this Safety Factor. However, it is applicable to all Safety Factors, and is addressed herein. CNSC staff have stated that in their view the CSA N286-12 version of CSA N286 “does not represent a fundamental change to the current Bruce Power Management System” and have acknowledged that “the new requirements in CSA N286-12 are already addressed in Bruce Power's program and procedure documentation” [27].

Bruce Power had agreed to perform a Gap Analysis and to prepare a detailed Transition Plan, and to subsequently implement the necessary changes in moving from the CSA N286-05 version of the code to the CSA N286-12 version, during the next licensing period [28]. This timeframe will facilitate the implementation of N286 changes to the management system, and enable the gap analysis results from the large number of new or revised Regulatory Documents or Standards committed in the 2015 operating licence renewal. Bruce Power has also proposed that in the interim, CSA N286-05 be retained in the PROL to enable it to plan the transition to CSA N286-12, and committed to develop the transition plan and communicate the plan to the

CNSC by January 30, 2016 [29]. Bruce Power further stated CSA N286-12 does not establish any significant or immediate new safety requirements that would merit a more accelerated implementation. This Safety Factor therefore has not performed a code-to-code assessment between CSA N286-05 and CSA N286-12 and will not be performing a clause-by-clause assessment of CSA N286-05, since it is in the current licence.

CSA N286.7-99: CSA N286.7-99 [23] has been assessed as part of the 2013 interim PSR and has not changed since this assessment. Furthermore, the Bruce Power Nuclear Safety Assessment procedure [52] cited in the Safety Factor 5 component of the 2013 interim PSR as demonstrating compliance with CSA N286.7-99 is unchanged. Therefore, review against these standards was not repeated as part of this Safety Factor.

CSA N290.13-05: CSA N290.13-05 [24] provides environmental qualification requirements for the design of Canada Deuterium Uranium (CANDU) Nuclear Power Plants (NPPs). A clause-by-clause review of the Bruce Units 1 and 2 Environmental Qualification (EQ) program against CSA N290.13-05 was conducted as part of the Bruce 1&2 ISR in 2008. The compliance assessment found that the EQ processes that are being applied for Units 1 and 2 comply with the requirements of the standard, except for two 'Acceptable Deviations'. Both these 'Acceptable Deviations' included references to seismic qualification requirements. The original Bruce A design requirements did not include seismic qualification; however, the Seismic Margin Assessment (SMA) of Bruce A [32] showed an adequate level of seismic robustness. The non-compliances were thus considered acceptable deviations as they have no significant adverse impact on plant safety. The standard has not been revised since the Bruce 1&2 ISR, nor has the SMA and the results of the Bruce 1&2 review remain applicable to Bruce A and B. Therefore, review of CSA N290.13-05 was not repeated for this Safety Factor.

CSA N290.15-10: CSA N290.15 [25] is the first edition of CSA standard for requirements for the safe operating envelope of nuclear power plants. This Standard provides requirements for the definition, implementation, and maintenance of the safe operating envelope at nuclear power plants. In addition, guidance material for existing Canada Deuterium Uranium (CANDU) nuclear power plants is provided in Annex A to support the requirements. The expectation is that Bruce Power will be compliant with this standard by September 2015 [33]. Therefore, there is no further discussion on this standard in this Safety Factor Report.

CSA N293-12: CSA N293-07 [34] defines the fire protection requirements for the design, construction, commissioning, operation, and decommissioning of CANDU NPPs. A recent review of the Bruce Power Fire Protection Program against CSA N293-07 has been performed [35] to satisfy a commitment to the CNSC to provide an assessment of the Fire Protection Program at Bruce A/B including the alignment with Fire Protection Codes and Standards [13]. As noted in the review [28], the submission of revised fire protection documentation [36] [37] [38], combined with adherence to a schedule for closure of issues arising from ongoing assessments conducted as part of the transition to N293-07 reports (see [39] as an example), have allowed CNSC staff to conclude that the requirements of CSA N293-07 are met. However, since CSA N293-07 has been superseded by CSA N293-12 [26], a code-to-code review is conducted as part of this Safety Factor, and the results are presented in Appendix C. As well, a clause-by-clause assessment is conducted for those clauses in CSA N293-12 without corresponding equivalent CSA N293-07 clauses; the results of this assessment, presented in Appendix B, indicate that Bruce A is compliant with all clauses of CSA N293-12 that differ from, or are new relative to, equivalent CSA N293-07 clauses.

3.3. Regulatory Documents

The Regulatory Documents in Table 2 were considered for application to review tasks of this Safety Factor.

Table 2: Regulatory Documents

Document Number	Document Title	Reference	Type of Review
CNSC R-77 (1987)	Overpressure Protection Requirements for Primary Heat Transport Systems in CANDU Power Reactors fitted with Two Shutdown Systems	[40]	CV
CNSC RD-346 (2008)	Site Evaluation for New Nuclear Power Plants	[41]	CV
CNSC REGDOC-2.5.2 (2014)	Design of Reactor Facilities: Nuclear Power Plants	[42]	CBC
Assessment type: Clause-by-Clause (CBC); Code-to-Code (CTC); High Level (HL); No Assessment Required (NR); Confirm Validity of Previous Assessments (CV)			

CNSC R-77: CNSC R-77 [40] provides overpressure protection requirements for primary heat transport systems in CANDU power reactors fitted with two shutdown systems, and is relevant to hazard analysis. A clause-by-clause review of R-77 was conducted in Enclosure 3 of [8] as part of the Bruce 1 and 2 ISR. Bruce A was found to be fully compliant with the requirements based on the results in the Safety Report for accidents which lead to pressurization of the heat transport system, i.e., Electrical System failures; Feedwater and Steam Supply System Failures; Loss of reactivity or Power Control; and Loss of Pressure Control (high). R-77 has not been revised since the Bruce 1 and 2 ISR, and no change has been made in the above Safety Report analyses that renders any results non-compliant with R-77. Therefore, review against CNSC R-77 was not repeated for this Safety Factor.

CNSC RD-346: CNSC RD-346 [41] came into effect after the Bruce 1 and 2 ISR. It represents the CNSC staff's adoption, or where applicable, adaptation of the principles set forth by the IAEA in NS-R-3 "Site Evaluation for Nuclear Installations" [43]. As stated in the Bruce 1 and 2 Systematic Review of Safety Basis document [44], "The IAEA guides under NS-R-3 relate to siting which has been fully addressed as part of the Environmental Assessment which has already been accepted by the CNSC." The same argument applies to CNSC RD-346. Therefore, CNSC RD-346 is not reviewed for this Safety Factor.

CNSC REGDOC-2.5.2: Table C-1 of the ISR Basis Document [1] calls for a code-to-code assessment of differences between RD-337 and CNSC REGDOC-2.5.2 [42], followed by a clause-by-clause assessment against only those CNSC REGDOC-2.5.2 clauses without corresponding equivalent RD-337 clauses. It was instead decided to do a clause-by-clause assessment against all clauses of CNSC REGDOC-2.5.2. Relevant clauses to Safety Factor 7 are assessed in Appendix B (B.2), while a fuller scope assessment is performed in "Safety Factor 1 – Plant Design".

3.4. CSA Standards

There are no CSA standards associated with this Safety Factor other than the ones cited in the PROL and discussed in Section 3.2 and Table 1.

3.5. International Standards

The international standard listed in Table 3 is relevant to this Safety Factor and was considered for this review.

Table 3: International Standards

Document Number	Document Title	Reference	Type of Review
IAEA SSG-25	Periodic Safety Review For Nuclear Power Plants	[3]	NR
Assessment type: Clause-by-Clause (CBC); Code-to-Code (CTC); High Level (HL); No Assessment Required (NR); Confirm Validity of Previous Assessments (CV)			

IAEA SSG-25: IAEA SSG-25 [3] addresses the periodic safety review of nuclear power plants and is the governing document for the review of the ISR, as identified in the Bruce A ISR Basis Document [1]. It defines the review tasks that should be considered for this Safety Factor. However, no assessment is performed specifically on IAEA SSG-25.

3.6. Other Applicable Codes and Standards

Other applicable standards/practices listed in Table 4 were considered for this review.

Table 4: Related Codes and Standards

Document Number	Document Title	Reference	Type of Review
Darlington DG-38-03650-2A	Common Mode Incidents – Overview and Design Requirements	[45]	NR
Darlington DG-38-03650-2B	Common Mode Incidents – Seismic Design	[46]	NR
Darlington DG-38-03650-3	Limiting Consequential Damage of Postulated Pipe Ruptures	[47]	NR
Assessment type: Clause-by-Clause (CBC); Code-to-Code (CTC); High Level (HL); No Assessment Required (NR); Confirm Validity of Previous Assessments (CV)			

Darlington Design Guides: Clause-by-clause reviews were conducted against the Darlington Design Guides as part of the Bruce 1 and 2 ISR. The documents provide general and seismic design requirements for Common Mode accidents and on consequential damage for postulated pipe ruptures. As noted in the Bruce 1&2 ISR review against Darlington-DG-38-03650-2A [45], Bruce A relies heavily on EQ and SMA approaches to demonstrate that one line of defence is available for common mode incidents. One line of defence has been accepted by the CNSC as a practicable approach for older plants to take towards dealing with common mode incidents.

However, CNSC REGDOC-2.5.2 [42] provides more detailed guidance in all these areas. Given the clause-by-clause review of CNSC REGDOC-2.5.2 provided in Appendix B (B.2), review against the Darlington Design Guides was not repeated for this Safety Factor.

4. Overview of Applicable Bruce A Station Programs and Processes

The objective of hazard analysis is to determine the adequacy of protection of the nuclear power plant against internal and external hazards, with account taken of the actual plant design, actual site characteristics, and actual plant condition. As such, hazard analysis has both design verification and safety analysis aspects.

Within the organization of Bruce Power's policies, programs and procedures there is no specific provision for hazard analysis as a distinct discipline. Instead, hazard analysis falls under the broader purview of Nuclear Safety Assessment, which covers activities such as deterministic safety analyses, probabilistic safety assessment and criticality safety assessment. The programmatic guidance for risk evaluation and hazard screening of any hazard are probabilistic safety assessment procedures. The programmatic guidance related to the design verification aspects of hazard analysis are design instructions relating to specific hazards such as seismic

events, fire and environmental qualification[4]. These design instructions fall under the Design Management Function. The Nuclear Safety Assessment Function, together with the Design Management Function, falls under Bruce Power's Plant Design Basis Management Program.

Nuclear safety is addressed at the highest level of the hierarchy in the Management System Manual BP-MSM-1 [49]. BP-MSM-1 includes Bruce Power Policy Statements that have superseded the Policy documents in place at the time of the Bruce 3 and 4 ISR. These find expression in programs such as the Fire Safety Management Plan [50] and the Plant Design Basis Management Program [51]. The Plant Design Basis Management Program is implemented through the following two high-level procedures:

- BP-PROC-00363 on Nuclear Safety Assessment [52]; and
- BP-PROC-00335 on Design Management [53].

The implementation of BP-PROC-00363 [52] on Nuclear Safety Assessment is supported by a variety of divisional and departmental procedures. Although there is no specific procedure addressing hazard analysis, many of the procedures have general applicability and support the hazard analysis process. The implementation of BP-PROC-00335 on Design Management [53] is also supported by a variety of divisional and departmental procedures. A number of these are relevant to hazard analysis, since they address design provisions for specific hazards. The list of Bruce Power policies, programs and procedures that are relevant to hazard analysis is provided in Table 5.[5]

Table 5: Key Implementing Documents

First Tier Documents	Second Tier Documents	Third Tier Documents	Fourth Tier Documents
BP-MSM-1: Management System Manual [49]	BP-PROG-00.02: Environmental Safety Management [54]		
	BP-PROG-08.01: Emergency Management Program [55]	BP-PLAN-00008: Fire Safety Management [50]	

[4] Updates to the PRA governance at Bruce Power following completion of the S-294 [48] project will reflect the external hazard elements that are captured by PRA assessments.

[5] Table 5 lists the key governance documents used to support the assessments of the review tasks for this Safety Factor Report. There is a continual process to update the governance documents; document versions may differ amongst individual Safety Factor Reports depending on the actual assessment review date. A full set of current sub-tier documents is provided within each current PROG document.

First Tier Documents	Second Tier Documents	Third Tier Documents	Fourth Tier Documents
	BP-PROG-10.01: Plant Design Basis Management [51]	BP-PROC-00261: Environmental Qualification [56]	SEC-EQD-00021: Environmental Qualification Assessments [59]
			SEC-EQD-00031: Preparation of Environmental Qualification Dossiers (EQD) [60]
		BP-PROC-00335: Design Management [53]	DPT-PDE-00017: Bruce Power Seismic Qualification Standard [30]
			DPT-PDE-00027: Fire Hazard Assessment Preparation and Maintenance [61]
			DPT-PDE-00028: Fire Safe Shutdown Analysis Maintenance [62]
			DPT-PDE-00029: Preparation of a Fire Protection Code Compliance Review [63]
			DPT-PDE-00030: Fire Protection Technical Evaluations [64]
			DPT-PDE-00031: Third Party Review – Fire Protection [65]
		BP-PROC-00363: Nuclear Safety Assessment [52]	DPT-NSAS-00001: Quality Assurance of Safety Analysis [66]

First Tier Documents	Second Tier Documents	Third Tier Documents	Fourth Tier Documents
			DPT-NSAS-00015: Planning and Execution of Nuclear Safety Assessments [67]
			DPT-RS-00002: Risk Assessment of Operational Events [68]
			DPT-RS-00006: Outage and Inage Risk Management [69]
		BP-PROC-00500: Control of Unsecured Equipment in Seismically Qualified Areas [31]	
		DPT-RS-00004: Risk Assessment of Proposed Changes to Engineering, Operations, Surveillance and Maintenance [57]	
		DPT-RS-00007: Preparation and Maintenance of Probabilistic Risk Assessments [58]	

In addition to these procedures, Bruce Power has also issued Probabilistic Risk Assessment (PRA) Methodology Guides for conduct of PRAs for the following internal and external hazards:

- B-REP-03611-00007, Bruce Power PRA Guide, Internal Flood [70];
- B-REP-03611-00008, Bruce Power PRA Guide, Internal Fire [71];
- B-REP-03611-00009, Bruce Power Seismic PRA Guide [72];
- B-REP-03611-00011, Bruce Power PRA Guide, Screening and Disposition of External Hazards [73];

- B-REP-03611-00012, Bruce Power PRA Guide, High Wind Hazard [74];
- B-REP-03611-00013, Bruce Power PRA Guide, External Flooding [75].

Given that the Bruce A Safety Report is referenced in the PROL, the following are implicitly part of the programmatic basis as artifacts of the programs and procedures above:

- NK21-SR-01320-00001, Bruce A 2012 Safety Report, Part 1: Plant and Site Description [76];
- NK21-SR-01320-00002, Bruce A 2012 Safety Report, Part 2: Plant Components and Systems [77];
- NK21-SR-01320-00003, Bruce A 2012 Safety Report, Part 3: Accident Analysis [78].

5. Results of the Review

The results of the review of this Safety Factor are documented below under headings that correspond to the review tasks listed in Section 1.2 of this document. The review tasks assessed in this section have not changed from those listed in Section 1.2. However, for convenience, the external hazards are discussed first, followed by the internal hazards.

5.1. Adequacy of Protection Against External Hazards

This task requires that the following representative list of external hazards that may affect plant safety be reviewed for adequacy of protection:

- Floods, including tsunamis;
- High winds, including tornadoes;
- Fire;
- Meteorological hazards (extreme temperatures, extreme weather conditions, high humidity, drought, snow, buildup of ice);
- Sun storm;
- Toxic and/or corrosive liquids and gases, other contamination in the air intake (for example, industrial contaminants, volcanic ash);
- Hydrogeological and hydrological hazards (extreme groundwater levels, seiches);
- Seismic hazards;
- Volcano hazards;
- Aircraft crashes, external missiles;
- Explosion;
- Biological fouling;
- Lightning strike;

- Electromagnetic or radio frequency interference;
- Vibration;
- Traffic; and
- Loss of internal and external services (cooling water, electricity, etc.).

5.1.1. Completeness of List of External Hazards

Bruce Power undertook, as part of its disposition of Fukushima Action Items, a re-evaluation of the site-specific magnitudes of each external event to which the plant might be susceptible, using modern calculations and methods; and an evaluation as to whether the current site-specific design protection for each external event so assessed is sufficient (these are designated FAI 2.1.1 and FAI 2.1.2 in [79]). An extensive screening assessment was conducted based on a screening methodology submitted to CNSC staff in [80]. The list of potential external hazards considered is provided in Table 6. This list covers all the external hazards outlined in Section 5.1, as well as several hazards that could be classified as internal hazards.

Table 6: Potential External Hazards

ID	Hazard	ID	Hazard
Airborne and Extra-Terrestrial Hazards			
A01	Extreme air pressure	A13	Salt storm
A02	Extreme rain	A14	Sandstorm
A03	Fog	A15	Snow
A04	Hail	A16	Solar storms
A05	High air pressure	A17	Tornadoes or waterspouts
A06	Hurricane / typhoon	A18	Aircraft impacts
A07	Ice store / sleet / freezing rain	A19	Electromagnetic interference / disturbance
A08	Lightning	A20	Externally generated missiles
A09	Low air temperature	A21	High air pollution
A10	Meteorite	A22	Satellite
A11	Mist	A23	Toxic gas/ chemical release/ radioactive release
A12	Other high winds		
Water-Based Hazards			
W01	Coastal erosion	W12	Other extraordinary waves
W02	Corrosion	W13	River diversion
W03	External flooding	W14	Seiche
W04	Frazil ice	W15	Storm surge

ID	Hazard	ID	Hazard
W05	Groundwater	W16	Strong currents
W06	High water temperature	W17	Tsunami
W07	High tide or water level	W18	Underwater landslide
W08	Ice barriers	W19	Waves
W09	Lake or river-borne material plugging water intakes	W20	Chemical releases into water
		W21	Impurities in water from ship release
W10	Low lake or river level	W22	Ship collisions
W11	Low water temperature	W23	Other ship collisions
Ground-Based Hazards			
G01	Animals	G13	Eddy currents into ground
G02	Avalanche	G14	Excavation work
G03	Biological events	G15	External fire
G04	Drought	G16	Ground contamination
G05	Erosion	G17	Ground vibration
G06	Forest fire	G18	Industrial or military facility accident
G07	Frost	G19	Internal fire spreading from other plant
G08	Ice cover	G20	Internally generated missiles
G09	Land rise	G21	Pipeline accident
G10	Landslide	G22	Release of chemicals from on-site storage
G11	Soil shrink-swell	G23	Transportation accidents
G12	Volcanic activity	G24	Turbine-generated missiles

These hazards were initially subjected to a first-level screening [81], and the hazards which were not eliminated in the first level were then subjected to a second level of screening ([82],[83]). Following this second level of screening, the only hazards requiring further assessment are tornados, high winds and external flooding. Bruce Power has also submitted [84] a methodology for analysis of tornados, high winds and external flooding, and has more recently submitted [85] a Bruce A High Wind PRA Report and Bruce A External Flood Assessment, as well as a Bruce A Seismic PRA Report and Bruce A Fire PRA Report.

5.1.2. Credible Magnitude and Associated Frequency of Occurrence of Hazard

The screening assessments [81] and [82] and revised PRAs [85] discussed in Section 5.1.1 included credible magnitude and frequency of occurrence as screening considerations.

5.1.3. Current Safety Standards

The current standards relevant to external hazards are discussed in Section 3.

5.1.4. Current Understanding of Environmental Effects

The screening assessments ([81],[82],[83]) discussed in Section 5.1.1 and Bruce A PRAs take account of environmental effects specific to the Bruce Power geographical location.

5.1.5. Capability of Plant to Withstand Hazard

Probabilistic screening assessments of external hazards ([81] and [82]) have allowed removal of most external hazards from concern in terms of plant capability.

The plant capability to withstand remaining external hazards is determined either by additional external hazards PRAs [85] which quantify the increase in Probabilistic Safety Assessment (PSA) measures (Severe Core Damage Frequency or Large Release Frequency), or by such deterministic assessments as a Bruce Seismic Margin Assessment [32], Fire Hazard Assessment [36] and Fire Safe Shutdown Analysis [37]. Regarding deterministic assessments, Safety Factor 5 identified gap SF5-2, which stated that "…Common-mode failure events are not included in Part 3 of the Safety Report."

The effect of ageing on the plant capability to withstand analyzed external hazards is managed by:

- an ageing management program that includes equipment lifecycle management and fitness-for-service evaluations, covered in more detail in Safety Factors 2 and 4;
- a PRA maintenance program to in incorporate up-to-date plant-specific component performance data (covered in more detail in Safety Factor 6).

5.1.6. Appropriateness of Procedures to Cover Operator Actions Claimed to Prevent or Mitigate Hazard

Bruce Power has Abnormal Incident Manuals, Emergency Operating Procedures and accident management procedures to guide the response to design basis accidents based on event symptoms, regardless of whether the hazard is internal or external in nature.

Severe Accident Management Guidelines (SAMGs) have been developed to guide the response to BDBAs based on the symptoms of the event. The status and plans for the Bruce Power SAMGs developed under Bruce Power's Severe Accident Management Program is described and assessed in Safety Factor 5.

5.2. Adequacy of Protection Against Internal Hazards

This task requires that the following representative internal hazards that may affect plant safety should be reviewed (additional site specific internal hazards should be included under this Safety Factor if appropriate):

- Fire (including measures for prevention, detection and suppression of fire);
- Flooding;
- Pipe whip;
- Missiles and drops of heavy loads;
- Steam release;
- Hot gas release;
- Cold gas release;
- Deluge and spray;
- Explosion;
- Electromagnetic or radio frequency interference;
- Toxic and/or corrosive liquids and gases;
- Vibration;
- Subsidence;
- High humidity;
- Structural collapse;
- Loss of internal and external services (cooling water, electricity, etc.);
- High voltage transients; and
- Loss or low capacity of air conditioning (which may lead to high temperatures).

5.2.1. Completeness of List of Internal Hazards

In the 2008 ISR Review of Safety Factor 7 submitted in [12], the list of assessed internal hazards consisted of:

- Fire (prevention, detection and suppression);
- Flooding;
- Pipe whip;
- Missiles;
- Steam release;

- Spray;
- Toxic gas; and
- Explosion.

The current set of assessed internal hazards as per the current ISR Basis Document [1] and as listed in Section 5.2, contains 13 additional internal hazards not explicitly considered in [12]:

- Drops of heavy loads;
- Hot gas release;
- Cold gas release;
- Deluge;
- Electromagnetic or radio frequency interference;
- Toxic and/or corrosive liquids and gases;
- Vibration;
- Subsidence;
- High humidity;
- Structural collapse;
- Loss of internal and external services (cooling water, electricity, etc.);
- High voltage transients; and
- Loss or low capacity of air conditioning (which may lead to high temperatures).

As discussed in Section 5.1.1, Bruce Power undertook a re-evaluation of the site-specific magnitudes of each external event to which the plant might be susceptible, using modern calculations and methods; and an evaluation as to whether the current site-specific design protection for each external event so assessed is sufficient. An extensive screening assessment was conducted, and the list of potential external hazards considered is provided in Table 6. Although deemed external hazards, some of the hazards in Table 6 could be considered as internal hazards as noted in Section 5.2, such as:

- electromagnetic or radio frequency interference;
- toxic and/or corrosive liquids and gases;
- high air temperature;
- internally generated missiles; and
- turbine-generated missiles.

This leaves eight internal hazards which have not yet been explicitly screened for potential relevance. However, the guidance surrounding the list of internal hazards in [3] (carried forward to [1]) is non-mandatory, as evidenced by use of the word “should” rather than “shall”. For this reason, the lack of a systematic review of potential internal hazards, comparable to the

systematic review of potential external hazards in [81], is deemed to be an Acceptable Deviation.

5.2.2. Credible Magnitude and Associated Frequency of Occurrence of Hazard

The absence of a systematic review of potential internal hazards precludes determination of credible magnitude and frequency of occurrence for all internal hazards to be considered.

5.2.3. Current Safety Standards

The current standards relevant to internal hazards are discussed in Section 3.

5.2.4. Current Understanding of Environmental Effects

Environmental effects are germane to assessment of external hazards, but not to internal hazards.

5.2.5. Capability of Plant to Withstand Hazard

The plant capability to withstand internal flood is assessed in the Bruce A Internal Flood PRA submitted in [86].

The plant`s protection against internal fire is assessed in the Bruce A Fire Hazard Assessment [36] and Fire Safe Shutdown Analysis [37].

The effects of pipe whip and jet impingement have been addressed in Bruce A primarily by showing that any pipe leak will be detected with sufficient reliability and warning time such that appropriate actions will be taken to avoid a pipe break (Leak-Before-Break) [87]. The assessment of the extent to which safety-related equipment inside the reactor vault is protected from pipe whip and jet impingement due to proximity to high-energy piping systems has been completed and issued to the CNSC [88]. Recently, probabilistic fracture mechanics calculations have been performed by the industry in support of reclassifying Category 3 Safety Issue IH6 “Need for systematic assessment of high energy line break effects” to Category 2. The industry program also supports the tracking of this issue under Action Item 1207-3509 for Bruce A and B. IH6 is now a Category 2 issue for the Bruce Power stations (also, see section 7.2).

The effect of ageing on the plant capability to withstand analyzed internal hazards is managed by:

- an ageing management program that includes equipment lifecycle management and fitness-for-service evaluations, covered in more detail in Safety Factor 2 and 4;
- a PRA maintenance program to in incorporate up-to-date plant-specific component performance data (covered in more detail in Safety Factor 6).

5.2.6. Appropriateness of Procedures to Cover Operator Actions Claimed to Prevent or Mitigate Hazard

Bruce Power has Abnormal Incident Manuals, Emergency Operating Procedures and accident management procedures to guide the response to design basis accidents based on event symptoms, regardless of whether the hazard is internal or external in nature.

SAMGs have been developed to guide the response to BDBAs based on the symptoms of the event. The status and plans for the Bruce Power SAMGs developed under Bruce Power's Severe Accident Management Program is described and assessed in Safety Factor 5.

6. Interfaces with Other Safety Factors

There is some degree of interrelationship among most of the 15 Safety Factors that comprise the Bruce A ISR. The following identifies specific aspects of this Safety Factor that are addressed in, or where more detail is provided in, another Safety Factor Report.

- "Safety Factor 1: Plant Design" in Section 5.2, addresses design provisions for internal and external hazards, such as seismic events and pipe whip, and in Section 3.6 discusses the updated National Building Code of Canada [89] and National Fire Code [90] of Canada.
- "Safety Factor 2: Actual Conditions of SSCs" in Section 5.1, addresses the condition and degradation of Structures, Systems and Components (SSCs)" as knowledge of the condition and degradation of SSCs is important when determining what upgrades and improvements are necessary for defense against external hazards.
- "Safety Factor 3: Equipment Qualification" in Appendix A.4, performs a high level review of the existing clause-by-clause assessment of Bruce Power programmatic guidance against requirements of CSA N290.13-05 which includes seismic qualification.
- "Safety Factor 4: Ageing" in Section 5.9, reviews the existing Bruce Power programmatic guidance which describes how fitness for service monitoring and safety analysis activities are coordinated to ensure that safety margins are adequate and ageing management issues are addressed.
- "Safety Factor 5: Deterministic Safety Analysis" in Section 5.7 describes and assesses the status and plans for Bruce Power SAMGs.
- "Safety Factor 6: Probabilistic Safety Analysis" through its analysis of the requirements of CNSC REGDOC-2.5.2 in Appendix B.2, addresses the frequency of occurrence for postulated events and the way that Postulated Initiating Events (PIEs) are identified and the use of PSA to assess the adequacy of the plant for events that are covered by the scope of hazard analysis.

7. Program Assessments and Adequacy of Implementation

Section 7 supplements the assessments of the review tasks in Section 5, by providing information on four broad methods used to identify the effectiveness with which programs are implemented, as follows:

- Self-Assessments;
- Internal and External Audits and Reviews;
- Regulatory Evaluations; and
- Performance Indicators.

For the first three methods, the most pertinent self-assessments, audits and regulatory evaluations are assessed. Bruce Power has a comprehensive process of reviewing compliance with Bruce Power processes, identifying gaps, committing to corrective actions, and following up to confirm completion and effectiveness of these actions. While there have been instances of non-compliance with Bruce Power processes, Bruce Power's commitment to continuous improvement is intended to correct any deficiencies.

For the fourth method, the performance indicators relevant to this Safety Factor are provided. These are intended to demonstrate that there is a metric by which Bruce Power assesses the effectiveness of the programs relevant to this Safety Factor.

Taken as a whole, these methods provide a cross section, intended to demonstrate that the processes associated with this Safety Factor are implemented effectively (individual findings notwithstanding). Thus, program effectiveness can be inferred if Bruce Power processes meet the Safety Factor requirements and if there are ongoing processes to ensure compliance with Bruce Power processes. This is the intent of Section 7.

7.1. Self-Assessments

Generally, self-assessments are used by functional areas to assess the adequacy and effective implementation of their programs. The results of the assessment are compared with business needs, the Bruce Power management system, industry standards of excellence and regulatory/statutory or other legal requirements.

The self-assessments:

- Identify internal strengths and best practices;
- Identify performance and/or programmatic gap(s) as compared to targets, governance standards and "best in class";
- Identify gaps in knowledge/skills of staff;
- Identify the extent of adherence to established processes and whether the desired level quality is being achieved;
- Identify adverse conditions and Opportunities for Improvements (OFI); and

- Identify the specific improvement corrective actions to close the performance/programmatic gap.

Since there are no procedures devoted exclusively to hazard analysis, no self-assessment addressing hazard analysis exclusively was performed. However, a number of self-assessments that interface to hazard analysis, either through management of hazardous materials or operations, through the relevant fire and EQ programs, or through deterministic or probabilistic safety analysis have been conducted. The relevant Focus Area Self Assessments (FASAs) that have been conducted since 2008 are listed in Table 7 as evidence of ongoing program effectiveness.

Table 7: Self Assessments Relevant to Safety Factor 7 Conducted since 2008

Assessment Number	Title
SA-NSAS-2008-03	Review of NSAS Support to Units 1 and 2 Restart Project
SA-PDE-2008-01	EQ Program Requirements
SA-BPMS-2009-02	Program Owner Awareness of N286.05
SA-ENV-2009-03	Zebra Mussel Management Program
SA-MPR-2009-03	Lifting, Rigging and Material Handling
SA-NSAS-2009-02	Probabilistic Risk Assessment Support for S-294 Implementation
SA-NSAS-2009-04	Support for Bruce Units 1 and 2 Restart and Units 3 and 4 Refurbishment
SA-PDE-2009-03	EQ Barrier Project – Baseline Complete and Sustained
SA-PE-2009-05	WANO AFI SOER 99-1 Rec 3 Loss of Grid
SA-RS-2009-01	Special Project Implementation: SAMG project
SA-CHM-2010-05	Zebra Mussel control Critical review of the current status
SA-COM-2010-02	EQ Program Sustainability
SA-OCP-2010-02	Conduct of Infrequently Performed Tests or Evolutions
SA-PDE-2010-01	Seismic Qualification Procedure Adherence for Bruce A Engineering Changes
SA-RA-2010-02	S-99 Preliminary Reporting Timeliness
SA-SAC-2010-01	Commissioning Readiness FASA for BP-PROG-12.02 & BP-PROG-00.02
SA-SAC-2010-08	Commissioning Readiness FASA for BP-PROG-00.04, 10.01, 10.02 & 10.03
SA-SAC-2010-20	Commissioning Readiness FASA for BP-PROG-00.03
SA-COM-2011-04	Technical Effectiveness of Component & System Condition Monitoring

Assessment Number	Title
	Activities on EQ Applications
SA-CSP-2011-05	Bruce A Chemical Cabinets
SA-HP-2011-01	Screening and Evaluating External OPEX
SA-WMSI-2011-04	Effectiveness of Actions Taken as a Result of CNSC Audit BNPD-2009-AB-009-A1
SA-COM-2012-02	EQ Program - Procedure Compliance and Effectiveness
SA-ENV-2012-01	Review of new CSA Standards
SA-CSP-2013-01	Bruce A Chemical Use and Storage
SA-SSO-2013-02	COS Scaffolding Processes
SA-MPR-2013-04	Procedure Use and Adherence - Bruce A (ongoing)
SA-EPS-2013-01	Effectiveness of Fire Pre-Define Work
SA-MPR-2013-02	Procedure Use and Adherence - Bruce B
SA-PI-2013-08	External OPEX applicability responses (ongoing)
SA-PI-2013-02	OPEX - Utilization of significant Internal OPEX (ongoing)
SA-MPR-2013-07	Lifting and Rigging (ongoing)
SA-MPR-2013-05	Rigging Lifting and Material Handling (ongoing)

7.2. Internal and External Audits and Reviews

The objective of the audit process as stated in BP-PROG-15.01 [91] is threefold:

- To assess the Management System and to determine if it is adequately established, implemented, and controlled;
- To confirm the effectiveness of the Management System in achieving the expected results and that risks are identified and managed; and
- To identify substandard conditions and enhancement opportunities.
- The objective is achieved by providing a prescribed method for evaluating established requirements against plant documentation, field conditions and work practices. The process describes the activities associated with audit planning, conducting, reporting, and closing-out. The results of the independent assessments are documented and reported to the level of management having sufficient breadth of responsibility for resolving any identified problems (as stated in Section 5.14.2 of [21]).

Since the Bruce 3&4 ISR was completed, a number of Bruce Power audits of significant relevance to this Safety Factor have been conducted. They are listed in Table 8 as evidence of ongoing program effectiveness.

To support the return to service of Bruce Units 1&2, Bruce Power conducted a systematic review of safety [9]. Table 4.2.3-2 in [9] provided suggested improvements related to hazard analysis. The related elements and their status from the current review are provided in Table 9.

In addition, CNSC staff provided comments on the Bruce 1&2 ISR review [92]. The shortcomings arising from these comments are as follows:

- The plant design does not incorporate sufficient diversity and separation to cope with the credible common cause events.
- The pipe whip hazard had previously been identified as an area of non-compliance but had been deemed acceptable because of low risk. This has subsequently become known as Category 2 Issue 8.

Bruce Power has third-party independent audits of its fire protection program: the 2010 and 2013 audit reports are documented in [93] and [94]. The 2013 audit resulted in 4 findings and 16 OFIs. Additionally, 26 items are reiterated from the Fire Protection Program audit activities of 2011 and 2012 because they were not addressed in the corrective action program or because the corrective action did not meet the expectation of the audit team.

Table 8: Audits Relevant to SFR7 Conducted since 2008

Audit Number	Title
AU-2008-00004	Fire Protection - Bruce A
AU-2008-00005	Fire Protection - Bruce B
AU-2008-00006	Centre of Site Fire Protection
AU-2008-00025	Emergency Response Plan
AU-2008-00029	Units 1&2 Restart Environmental Qualification Program
AU-2008-00032	OPEX Program
AU-2008-00046	Unit 1 & 2 Quality Program Audit
AU-2009-00001	EMS Program and Compliance
AU-2009-00002	Bruce B Conduct of Operations
AU-2009-00004	PB Design, Documentation and Records Audit
AU-2009-00007	Bruce A Fire Protection Program
AU-2009-00008	Bruce B Fire Protection Program
AU-2009-00019	Units 1 & 2 Restart EQ Program Audit
AU-2009-00039	Conduct of Operations Follow Up July 2009
AU-2009-00041	ERT Fire Drill Capability
AU-2009-00049	Emergency Measures Schedule Compliance

Audit Number	Title
AU-2010-00003	Hazard Waste Management Audit
AU-2010-00005	EMS Program/Compliance Audit
AU-2010-00029	Reporting of S-99 Emergency and Fire Events
AU-2010-00031	N286-05 Implementation
AU-2010-00040	Fire Protection Program
AU-2011-00006	Nuclear Emergency Plan
AU-2011-00016	Environmental Qualification
AU-2013-00004	Emergency Measures
AU-2013-00007	Bruce Power Management System
AU-2013-00016	Fire Protection Program

Table 9: Bruce 1&2 ISR Report – Suggested Improvements Related to Safety Factor 7

Observation	B1&2 Comment	Status in 2008 Review
Environmental Qualification for steam line breaks	This uses a risk-based approach for survival of some remote critical equipment based on barriers and emergency venting.	There is a provision of main steam isolation valves in newer NPPs. One of their main functions is to stop steam flow into the powerhouse following a steam line failure. The alternative approach taken at Bruce A has been to environmentally qualify the essential systems to enable shutdown, cooldown, containment and monitoring of any fission product release. This alternative approach has been accepted by the CNSC.

7.3. Regulatory Evaluations and Reviews

After a licence is issued, the CNSC stringently evaluates compliance by the licensee on a regular basis. In addition to having a team of onsite inspectors, CNSC staff with specific technical expertise regularly visit plants to verify that operators are meeting the regulatory requirements and licence conditions. Compliance activities include inspections and other oversight functions that verify a licensee's activities are properly conducted, including planned Type I inspections (detailed audits), Type II inspections (routine inspections), assessments of information submitted by the licensee to demonstrate compliance, and other unplanned inspections in response to special circumstances or events.

Type I inspections are systematic, planned and documented processes to determine whether a licensee program, process or practice complies with regulatory requirements. Type II inspections are planned and documented activities to verify the results of licensee processes and not the processes themselves. They are typically routine inspections of specified equipment, facility material systems or of discrete records, products or outputs from licensee processes.

The CNSC carefully reviews any items of non-compliance and follows up to ensure all items are quickly corrected.

In the last five years the CNSC inspections that have been conducted are listed in Table 10:

Table 10: CNSC Compliance Inspections Related to SF 7

Inspection Report Title	Reference
Corporate Emergency Exercise	[95]
Emergency Power Supply System	[96]
All Units Fire Protection Walkdown	[97]
Walkdown of IIP POST-LOCA Mitigation Modifications	[98]
Transportation Emergency Response Plan	[99]
Environmental Qualification of Bruce A Units 1 and 2	[100]
Reactive Inspection Relating to Initial Lessons Learned from Japanese Nuclear Event	[101]
Fire Protection Inspection of Very Early Warning Air Aspirating Smoke Detection Systems	[102]
Bruce A Environmental Qualification Program Inspection Report	[103]
Units 5-8 Fire Protection Walkdown	[104]
Bruce Power Industrial Fire Brigade	[105]
Ancillary Services Building (ASB) Monthly Fire Protection Walkdown	[106]
Pumphouse and Water Treatment Plant Monthly Fire Protection Walkdown	[107]
Emergency Preparedness and Radiation Protection	[108]
Compliance with Bruce Power Nuclear Emergency Plan	[109]
Fire Protection Walkdown - Bruce A All Units	[110]
EPS Fire Drill – Bruce A and Bruce B	[111]

The last two Inspections in Table 10 are of particular relevance to fire protection:

The CNSC conducted an annual fire protection compliance inspection for Bruce A (Unit 0A and Units 1 to 4). The inspection report [110] concludes that:

- Bruce Power is meeting the regulatory requirements;

- Minor non-compliances with licensee procedures were immediately corrected by licensee staff;
- An overall improvement concerning fire protection issues in the areas inspected was noted by auditors; and
- No actions were raised as a result of the inspection, and no corrective actions were required.

The CNSC conducted an audit of the fire drill component of the Fire Response program by observing a fire drill at Bruce A and one at Bruce B. In the audit report [111], it is concluded that:

- Bruce Power has a very well-structured fire drill program;
- There is a systematic approach in each step of the fire response;
- There were some areas of improvement noted by CNSC staff, which resulted in three Action Notices and six Recommendations[6]. In [112], Bruce Power provided responses to the action notices and recommendations and requested closure of the action item. Specifically, Bruce Power committed to revise two governance documents, to incorporate into a third governance document the guidance provided in NFPA 600 regarding establishment of zones for emergency events, and to provide better guidance and fully describe the accounting practices used; these committed tasks are all shown to be in progress in Bruce Power's Action Tracking system.

7.4. Performance Indicators

Performance indicators are defined as data that are sensitive to and/or signal changes in the performance of systems, components, or programs.

There are no specific performance indicators associated with hazard analysis or any of the relevant programs and procedures.

[6] An Action Notice is a request to correct a non-compliance that is not a contravention of applicable regulations, licence conditions, codes or standard, but that compromise safety. A Recommendation is a written suggestion to effect an improvement based on good industry practice.

8. Summary and Conclusions

The overall objective of the Bruce A ISR is to conduct a review of Bruce A against modern codes and standards and international safety expectations and provide input to a practicable set of improvements to be conducted during the Major Component Replacement in Units 3 and 4, and during asset management activities to support ongoing operation of all four units, that will enhance safety to support long term operation. The specific objective of the review of this Safety Factor is to determine the adequacy of protection of the nuclear power plant against internal and external hazards with account taken of the actual plant design, actual site characteristics, the actual condition of SSCs and their predicted state at the end of the period covered by the ISR, and current analytical methods, safety standards and knowledge. This specific objective has been met by the completion of the review tasks specific to hazard analysis.

No specific strengths were identified specific to hazard analysis.

The overall conclusion is that Bruce Power's programs meet the requirements of the Safety Factor related to Hazard Analysis.

9. References

[1] NK21-CORR-00531-11617, Integrated Safety Review for Bruce A, Bruce Power Letter, F. Saunders to K. Lafrenière, including enclosure K-421231-00010-R00, Candesco Report, October 27, 2014.

[2] NK21-CORR-00531-11005/NK29-CORR-00531-11397, Submission of Safety Basis Report, Bruce Power Letter, F. Saunders to R. Lojk, December 30, 2013.

[3] IAEA SSG-25, Periodic Safety Review of Nuclear Power Plants, IAEA, March 2013.

[4] CNSC RD-360, Life Extension of Nuclear Power Plants, CNSC, February 2008.

[5] NK21-CORR-00531-03839, Bruce A Environmental Assessment Study Report, Bruce Power, December 7, 2005.

[6] CNSC REGDOC-2.3.3, Operating Performance: Periodic Safety Reviews, CNSC, April 2015.

[7] NK21-CORR-00531-00514, Bruce A: CNSC Approval to Restart Units 3 and 4 and Application to Amend PROL 15.01/2003, Bruce Power Letter, F. Saunders to J.H.M. Douglas, November 16, 2001.

[8] NK21-CORR-00531-04059, Bruce A Refurbishment for Life Extension – Systematic Review of Safety: Plant Design, Bruce Power Letter, F. Saunders to P. Webster, March 30, 2006.

[9] NK21-CORR-00531-04339, Bruce A Units 1 and 2 Return to Service – Systematic Review of Safety, Bruce Power Letter, F. Saunders to P. Webster, July 31, 2006.

[10] NK21-CORR-00531-05976, Bruce A Units 3 and 4 Refurbishment for Life Extension and Continued Operation: ISR Safety Factor Reports, Bruce Power Letter, F. Saunders to P. Elder, June 2, 2008.

[11] NK21-CORR-00531-06596, Bruce A Units 3 and 4 Refurbishment for Life Extension and Continued Operation: ISR Safety Factor Reports 1, 2, 3 and 4, Bruce Power Letter, F. Saunders to K. Lafrenière, December 18, 2008.

[12] NK21-CORR-00531-06076, Bruce A Units 3 and 4 Refurbishment for Life Extension and Continued Operation: ISR Safety Factor Reports 5, 6, and 7, Bruce Power Letter, F. Saunders to P. Elder, July 22, 2008.

[13] NK21-CORR-00531-10576/NK29-CORR-00531-10975, Application Requirements for Renewal of Power Reactor Operating Licences for Bruce Nuclear Generating Stations A and B, Bruce Power Letter, F. Saunders to R. Lojk, July 17, 2013.

[14] Nuclear Safety and Control Act, 1997, c. 9, N-28.3, Assented to March 20, 1997.

[15] NK21-CORR-00531-11272, Nuclear Power Reactor Operating Licence, Bruce Nuclear Generating Station A (PROL 15.00/2014), May 1, 2014.

[16] NK21-CORR-00531-11391, Bruce Nuclear Generating Station A Nuclear Power Reactor Operating Licence: Licence Conditions Handbook (LCH-BNGSA-R8), June 4, 2014.

[17] PROL 18.00/2020, e-Doc 4723908, Nuclear Power Reactor Operating Licence, Bruce Nuclear Generating Station A and Bruce Nuclear Generating Station B, June 1, 2015.

[18] LCH-BNGS-R000, e-Doc 4659316, Bruce Nuclear Generating Station A and Bruce Nuclear Generating Station B Power Reactor Operating Licence, June 1, 2015.

[19] CNSC RD-310, Safety Analysis for Nuclear Power Plants, CNSC, February 2008.

[20] CNSC REGDOC-2.4.1, Deterministic Safety Analysis, CNSC, May 2014.

[21] CAN/CSA N286-05, Management System Requirements for Nuclear Facilities, CSA, February 2005 (Update 2, December 2010).

[22] CAN/CSA N286-12, Management System Requirements for Nuclear Facilities, CSA, June 2012.

[23] CAN/CSA N286.7-99, Quality Assurance of Analytical, Scientific and Design Computer Programs for Nuclear Power Plants, CSA, March 1999, R2012.

[24] CSA N290.13-05, Environmental Qualification of Equipment for CANDU Nuclear Power Plants, CSA, February 2005, R2010.

[25] CAN/CSA N290.15-10, Requirements for the Safe Operating Envelope of Nuclear Power Plants, CSA, August 2010.

[26] CSA N293-12, Fire Protection for CANDU Nuclear Power Plants, CSA, October 2012.

[27] NK21-CORR-00531-11494, Response to Bruce Power Letter, CSA N286-12 - Management System Requirements for Nuclear Facilities, Action Item 1307-4697, CNSC Letter, K. Lafrenière to F. Saunders, July 24, 2014.

[28] NK21-CORR-00531-11189/NK29-CORR-00531-11593, Action Item 1307-4697: CSA N286-12 - Management System Requirements for Nuclear Facilities, Bruce Power Letter, F. Saunders to K. Lafrenière, May 16, 2014.

[29] NK21-CORR-00531-11563, CSA N286-12 - Management System Requirements for Nuclear Facilities, Action Item 1307-4697, Bruce Power Letter, F. Saunders to K. Lafrenière, September 9, 2014.

[30] DPT-PDE-00017-R005, Bruce Power Seismic Qualification Standard, Bruce Power, July 4, 2012.

[31] BP-PROC-00500- R001, Control of Unsecured Equipment in Seismically Qualified Areas, Bruce Power, December 10, 2008.

[32] NK21-REP-20091-00001-R002, Bruce NGS A Seismic Margin Assessment, Bruce Power, November 2003.

[33] NK21-CORR-00531-11728/NK29-CORR-00531-12117, Bruce A and Bruce B CSA N290.15 Compliance Update, Bruce Power Letter, F. Saunders to K. Lafrenière, December 9, 2014.

[34] CSA N293-07, Fire Protection for CANDU Nuclear Power Plants, CSA, January 2008.

[35] B-REP-00701-29NOV2013-059-R000, Assessment of Fire Protection at Bruce Power, Bruce Power, November 29, 2013.

[36] NK21-REP-71400-00003-R05, Bruce NGS A Fire Hazards Assessment, Bruce Power, August 2012.

[37] NK21-REP-71400-00004-R06, Bruce NGS A Fire Safe Shutdown Analysis, Bruce Power, August 2012.

[38] NK21-REP-71400-00005-R05, Bruce NGS A Fire Protection Code Compliance Review, Bruce Power, August 2012.

[39] NK21-CORR-00531-11574/NK29-CORR-00531-11955, Action Item 1207-3890: CSA N293 Transition Summary Report, Bruce Power Letter, F. Saunders to K. Lafrenière, October 3, 2014.

[40] CNSC R-77, Overpressure Protection Requirements for Primary Heat Transport Systems in CANDU Power Reactors Fitted with Two Shutdown Systems, CNSC, October 1987.

[41] CNSC RD-346, Site Evaluation for New Nuclear Power Plants, CNSC, November 2008.

[42] CNSC REGDOC-2.5.2, Design of Reactor Facilities: Nuclear Power Plants, CNSC, May 2014.

[43] IAEA NS-R-3, Site Evaluation for Nuclear Installations, IAEA Safety Requirements, November 2003.

[44] NK21-CORR-00531-04636, Bruce A Units 1 and 2 Return to Service: Systematic Review of Safety Basis, Bruce Power Letter, F. Saunders to D. Desjardins, December 22, 2006.

[45] Darlington-DG-38-03650-2A, Common Mode Incidents – Overview and Design Requirements.

[46] Darlington-DG-38-03650-2B, Common Mode Incidents – Seismic Design.

[47] Darlington-DG-38-03650-3, Limiting Consequential Damage of Postulated Pipe Ruptures.

[48] CNSC S-294, Probabilistic Safety Assessment for Nuclear Power Plants, CNSC, April 2005.

[49] BP-MSM-1-R012, Management System Manual, Bruce Power, June 2014.

[50] BP-PLAN-00008-R003, Fire Safety Management, Bruce Power, May 1, 2013.

[51] BP-PROG-10.01-R009, Plant Design Basis Management, Bruce Power, December 4, 2014.

[52] BP-PROC-00363-R003, Nuclear Safety Assessment, Bruce Power, January 24, 2013.

[53] BP-PROC-00335-R006, Design Management, Bruce Power, May 24, 2013.

[54] BP-PROG-00.02-R009, Environmental Safety Management, Bruce Power, October 2014.

[55] BP-PROG-08.01-R007, Emergency Management Program, Bruce Power, December 16, 2013.

[56] BP-PROC-00261-R005, Environmental Qualification, Bruce Power, November 7, 2012.

[57] DPT-RS-00004- R001, Risk Assessment of Proposed Changes to Engineering, Operations, Surveillance and Maintenance, Bruce Power, October 4, 2011.

[58] DPT-RS-00007-R001, Preparation and Maintenance of Probabilistic Risk Assessments, Bruce Power, February 15, 2007.

[59] SEC-EQD-00021-R003, Environmental Qualification Assessments, Bruce Power, January 19, 2013

[60] SEC-EQD-00031-R002, Preparation of Environmental Qualification Dossiers, Bruce Power, June 27, 2011.

[61] DPT-PDE-00027- R003, Fire Hazard Assessment Preparation and Maintenance, Bruce Power, October 3, 2009.

[62] DPT-PDE-00028- R004, Fire Safe Shutdown Analysis Maintenance, Bruce Power, October 28, 2013.

[63] DPT-PDE-00029- R003, Preparation of a Fire Protection Code Compliance Review, Bruce Power, January 13, 2010.

[64] DPT-PDE-00030-R003, Fire Protection Technical Evaluations, Bruce Power, December 1, 2009.

[65] DPT-PDE-00031- R005, Third Party Review – Fire Protection, Bruce Power, August 22, 2013.

[66] DPT-NSAS-00001-R006, Quality Assurance of Safety Analysis, Bruce Power, August 20, 2014.

[67] DPT-NSAS-00015-R004, Planning and Execution of Nuclear Safety Assessments, Bruce Power, October 16, 2013.

[68] DPT-RS-00002- R000, Risk Assessment of Operational Events, Bruce Power, January 31, 2007.

[69] DPT-RS-00006- R001, Outage and Inage Risk Management, Bruce Power, January 28, 2011.

[70] B-REP-03611-00007-R000, Bruce Power PRA Guide, Internal Flood, Bruce Power, January 2011.

[71] B-REP-03611-00008-R000, Bruce Power PRA Guide, Internal Fire, Bruce Power, February 2011.

[72] B-REP-03611-00009-R000, Bruce Power Seismic PRA Guide, Bruce Power, November 2010.

[73] B-REP-03611-00011-R001, Bruce Power PRA Guide, Screening and Disposition of External Hazards, Bruce Power, February 2012.

[74] B-REP-03611-00012-R000, Bruce Power PRA Guide, High Wind Hazard, Bruce Power, November 2012.

[75] B-REP-03611-00013-R000, Bruce Power PRA Guide, External Flooding, Bruce Power, April 2014.

[76] NK21-SR-01320-00001-R005, Bruce A 2012 Safety Report, Part 1: Plant and Site Description, Bruce Power, February 2013.

[77] NK21-SR-01320-00002-R005, Bruce A 2012 Safety Report, Part 2: Plant Components and Systems, Bruce Power, February 2013.

[78] NK21-SR-01320-00003-R004, Bruce A 2012 Safety Report, Part 3: Accident Analysis, Bruce Power, January 2012.

[79] NK21-CORR-00531-09676/NK29-CORR-00531-10193, Bruce Power Progress Report No. 1 on CNSC Action Plan – Fukushima Action Items, Bruce Power Letter, F. Saunders to R. Lojk, July 16, 2012.

[80] NK21-CORR-00531-09253/NK29-CORR-00531-09881, Submission of Revised Bruce Power Probabilistic Risk Assessment Guide – Screening and Disposition of External Events, Bruce Power Letter, F. Saunders to R. Lojk, March 9, 2012.

[81] NK21-CORR-00531-09809/NK29-CORR-00531-10287, Bruce A and B External Hazard Assessment, Bruce Power Letter, F. Saunders to R. Lojk, September 28, 2012.

[82] NK21-CORR-00531-10848/NK29-CORR-00531-11226, Bruce A and B External Hazard Assessment, Bruce Power Letter, F. Saunders to R. Lojk, December 12, 2013.

[83] NK21-CORR-00531-11091/NK29-CORR-00531-11491, S-294 Probabilistic Risk Assessment Confirmatory Activities, Bruce Power Letter, F. Saunders to R. Lojk, March 31, 2014.

[84] NK21-CORR-00531-09969/NK29-CORR-00531-10409, Methodology for Tornados, High Winds and External Flooding, Bruce Power Letter, F. Saunders to R. Lojk, November 27, 2012.

[85] NK21-CORR-00531-11324/NK29-CORR-00531-11729, Submission of S-294 Probabilistic Risk Assessment Final Reports, Bruce Power Letter, F. Saunders to K. Lafrenière, July 31, 2014.

[86] NK21-CORR-00531-10958/NK29-CORR-00531-11342, Submission of S-294 Probabilistic Risk Assessment Deliverables, Bruce Power Letter, F. Saunders to R. Lojk, December 24, 2013.

[87] RABA 0804, Review of Bruce NGSA against Modern Safety Standards RD-337 Review, October 16, 2008.

[88] NK21-CORR-00531-10873, Application for the Renewal of the: Power Reactor Operating Licence for Bruce Nuclear Generating Station A (Attachment I: Station Improvement Plans), Bruce Power Letter, F. Saunders to M.A. Leblanc, October 31, 2013.

[89] National Building Code of Canada, 2010.

[90] National Fire Code of Canada, 2010.

[91] BP-PROG-15.01-R004, Nuclear Oversight Management, Bruce Power, December 18, 2013.

[92] NK21-CORR-00531-04994, Bruce Units 1-2 Return To Service and Life Extension: CNSC Review of the Bruce Power's Systematic Review Of Safety, CNSC Letter, D.A. Desjardins to F. Saunders, May 18, 2007.

[93] AU-2010-00040, Annual Fire Protection Audit, November 2010.

[94] AU-2013-00016, Third Party Fire Protection Program Audit, January 2014.

[95] NK21-CORR-00531-08814/NK29-CORR-00531-09535, Action Item 100719: A / B CNSC Compliance Inspection Report BRPD-2010-AB-009, Bruce Power Corporate Emergency Exercise, July 12, 2011.

[96] NK29-CORR-00531-09995, Bruce B Compliance Inspection Report BRPD-B-2012-021 Emergency Power Supply System Inspection, March 30, 2012.

[97] NK29-CORR-00531-08810, Bruce B Compliance Inspection Report BRPD-2010-B-031 Units 5-8 Fire Protection Walkdown, May 19, 2010.

[98] NK21-CORR-00531-09659, BRPD-R-2012-024: Bruce A Unit 1 Walkdown of IIP Post-LOCA mitigation modifications, July 6, 2012.

[99] NK21-CORR-00531-08366/NK29-CORR-00531-09152/NK37-CORR-00531-01653, Transportation Emergency Response Plan CNSC Compliance Inspection Report EMPD-BP-2010-T18441, December 10, 2012.

[100] NK21-CORR-00531-10094, Bruce A CNSC Compliance Inspection Report BRPD-R-2012-038 – Environmental Qualification of Bruce A Units 1 and 2, December 12, 2012.

[101] NK21-CORR-00531-08610/NK29-CORR-00531-09356, Action Items 110716, 110717 and 111402: Reactive Inspection Relating to Initial Lessons Learned from Japanese Nuclear Event, March 29, 2011.

[102] NK21-CORR-00531-08299/NK29-CORR-00531-09114, Bruce A and B CNSC Compliance Inspection Report BRPD-2010-AB-011 Bruce Power Protection Inspection of Very Early Warning Air Aspirating Smoke Detection Systems, November 16, 2010.

[103] NK21-CORR-00531-06188, Inspection of the Bruce A Environmental Qualification Program, Report No. SED-BA-2005-T3452-06, Revision 1, June 20, 2008.

[104] NK29-CORR-00531-08810, Bruce B CNSC Compliance Inspection Report BRPD-2010-B-031 Units 5-8 Fire Protection Walkdown, May 11, 2010.

[105] NK21-CORR-00531-07314/NK29-CORR-00531-08381, Bruce Power Industrial Fire Brigade Type II Inspection, August 14, 2009.

[106] NK21-CORR-00531-07244, Bruce A CNSC Compliance Inspection Report BRPD-2009-A-042 Bruce A – Ancillary Services Building (ASB) Monthly Fire Protection Walk Down, Canadian, July 16, 2009.

[107] NK21-CORR-00531-07245, Bruce A CNSC Compliance Inspection Report BRPD-2009-A-041 Bruce A, Unit 1, 2, 3, 4 Pumphouse and Water Treatment Plant Monthly Fire Protection Walkdown, July 16, 2009.

[108] NK29-CORR-00531-07937, Type II Inspection – IDB-2008-B-040 Bruce B – Emergency Preparedness and Radiation Protection Walk Down Inspection, January 12, 2009.

[109] NK21-CORR-00531-06157/NK29-CORR-00531-07054, Type I Inspection Notification – Compliance with Bruce Power Nuclear Emergency Plan, June 5, 2008.

[110] NK21-CORR-00531-10158, CNSC Type II Compliance Inspection Report: Fire Protection Walkdown Bruce A All Units, Report # BRPD-A-2012-021, January 10, 2013.

[111] NK21-CORR-00531-10589/NK29-CORR-00531-10984, Action Item 1307-4158: EPS Fire Drill Bruce A and B, BRPD-AB-2013-007, CNSC Letter, R. Lojk to F. Saunders, June 11, 2013.

[112] NK21-CORR-00531-10658/NK29-CORR-00531-11048, Action Item 1307-4158: Response to EPS Fire Drill Bruce A and B – Report No. BRPD-AB-2013-007, Bruce Power Letter, F. Saunders to R. Lojk, August 27, 2013.

Appendix A – High-Level Assessments Against Relevant Codes and Standards

No codes or standards relevant to Safety Factor 7 were subjected to high-level assessment. This Appendix is retained only for consistency with the Appendix numbering scheme in all other Safety Factor Reports.

Appendix B – Clause-By-Clause Assessments Against Relevant Codes and Standards

This appendix presents the clause-by-clause assessments that are performed for this Safety Factor. The ISR Basis Document [1] provides the following compliance categories and definitions for clause-by-clause assessments:

- Compliant (C) – compliance has been demonstrated with the applicable clause;
- Indirect Compliance (IC) – Compliance has been demonstrated with the intent of the applicable clause;
- Acceptable Deviation (AD) – Compliance with the applicable clause cannot be demonstrated; however, a technical assessment has determined that the deviation is acceptable. For this case a detailed discussion and explanation shall be included in the ISR documentation;
- Gap – system design and/or operational improvements may be necessary;
- Guidance: A potential programmatic, engineering, analytical or effectiveness gap found against non-mandatory guidance;
- Relevant but not Assessed (RNA) – The ISR Basis Document defines RNA as "the particular clause provides requirements that are less strenuous than clauses of another standard that has already been assessed". The definition has been broadened to include the guidance portion of clauses in which a gap has already been identified against the requirement;
- Not Relevant (NR) – The topic addressed in the specific clause is not relevant to the safety factor under consideration but may well be assessed under a different Safety Factor; and
- Not Applicable (NA) – The text is not a clause that provides requirements or guidance. Also used if the clause does not apply to the specific facility.

B.1. CNSC REGDOC-2.4.1, Deterministic Safety Analysis

In support of the review tasks listed in Section 5 relevant clauses of CNSC REGDOC-2.4.1 have been assessed in Table B1. A more detailed assessment is performed in “Safety Factor 5 – Deterministic Safety Analysis”.

Table B1: CNSC REGDOC-2.4.1, Deterministic Safety Analysis

Article No.	Clause Requirement	Assessment	Compliance Category
4.2.1	The licensee shall use a systematic process to identify events, event sequences, and event combinations (“events” hereafter in this document) that can potentially challenge the safety or control functions of the NPP. The licensee shall also identify events that may lead to fission product releases, including those related to spent fuel pools (also called irradiated fuel bays) and fuel-handling systems. This process shall be based on regulatory requirements and guidance, past licensing precedents, operational experience, engineering judgment, results of deterministic and probabilistic assessments, and any other systematic reviews of the design. The identification of events will include at-power and shutdown states. The deterministic analysis should also be performed for other states where the reactor is expected to operate for extended periods of time and that are not covered by the at-power and shutdown analysis. Common-cause events affecting multiple reactor units on a site shall be considered. The list of identified events shall be reviewed for completeness during the design and analysis process and modified as necessary.	The only element of this clause that is relevant to Hazard Analysis is paragraph 3 of the guidance: "The set of events to be considered in safety analysis is identified using a systematic process and by taking into account: * reviews of the plant design using such methods as hazard and operability analysis, failure mode and effects analysis, and master logic diagrams" This is covered in more detail in the assessment against CNSC REGDOC-2.5.2 clause 7.4.	RNA

Article No.	Clause Requirement	Assessment	Compliance Category
	In addition to events that could challenge the safety or control functions of the NPP, safety analysis shall be performed for normal operation. Guidance The safety analysis is performed for a set of events that could lead to challenges related to the NPP's safety or control functions. These include events caused by SSC failures or human error, as well as human-induced or natural common-cause events. The events considered in safety analysis could be single PIEs, sequences of several consequential events, or combinations of independent events. The set of events to be considered in safety analysis is identified using a systematic process and by taking into account: • reviews of the plant design using such methods as hazard and operability analysis, failure mode and effects analysis, and master logic diagrams • lists of events developed for safety analysis of other NPPs, as applicable • analysis of operating experience data for similar plants • any events prescribed for inclusion in safety analysis by regulatory requirements (e.g., REGDOC-2.5.2, Design of Reactor Facilities: Nuclear Power Plants) • equipment failures, human errors and common-cause events identified iteratively with PSA • a cut-off frequency for common-cause events that is consistent across all events The list of identified events should be iteratively reviewed for accuracy and completeness as the plant		

Article No.	Clause Requirement	Assessment	Compliance Category
	design and safety analyses proceed. Reviews should also be periodically conducted throughout the NPP lifecycle, to account for new information and requirements. This regulatory document requires that, when identifying events, all permissible plant operating modes be considered. All operating modes used for extended periods of time should be analyzed. Modes that occur transiently or briefly can be addressed without a specific analysis, as long as it can be shown that existing safety analyses bound the behaviour and consequences of those states. NPP operating modes include, but are not limited to: • initial approach to reactor criticality • reactor start-up from shutdown through criticality to power • steady-state power operation, including both full and low power • changes in the reactor power level, including load follow modes (if employed) • reactor shutting down from power operation • shutdown in a hot standby mode • shutdown in a cold shutdown mode • shutdown in a refuelling mode or maintenance mode that opens major closures in the reactor coolant pressure boundary • shutdown in other modes or plant configurations with unique temperature, pressure or coolant inventory conditions • operation of limited duration, with some systems important to safety being unavailable		

Article No.	Clause Requirement	Assessment	Compliance Category
	For events identified by the systematic process used for this purpose, a full range of configurations and operating modes of equipment should be considered in the deterministic safety analysis. Special plant configurations may occur during major plant modifications such as plant refurbishment, lay-up, or decommissioning. These configurations should be considered, and potential events should be identified and included in the deterministic safety analysis.		
4.2.2.4	Common-cause events are multiple component failures that can be initiated by internal and external events (these events could be human-induced or naturally occurring). Internal common-cause events include fires, floods of internal origin, explosions, and equipment failures (such as turbine breakup) that may generate missiles. External, naturally occurring events (triggers for plant equipment failures) that are considered in deterministic safety analysis include: • earthquakes • external fires • floods/tsunamis occurring outside the site • biological hazards (for instance, mussels or seaweed affecting cooling water flow and/or temperature) • extreme weather conditions (temperature, precipitation, high winds, tornadoes etc.) External initiating events may cause internal and/or external events. For example, an earthquake could lead to plant equipment failures, loss of offsite power, flood, tsunami or fire. External events may cause accidents in	All external and most internal hazards that could potentially serve as the initiator of common-cause events were subjected to a first level of screening in order to eliminate ones which are inapplicable to Bruce A or with too low a frequency. The first level screening report was submitted to CNSC staff in NK21-CORR-00531-09809. The remaining hazards were submitted to a second level screening (submitted in NK21-CORR-00531-10848) which eliminated from consideration for further assessment all but the following events: *Fire *Earthquake; *Tornado; *External flooding and extreme waves. The detailed hazard analysis of protection against fire is generated as per DPT-PDE-00027, DPT-PDE-00028 and DPT-PDE-00029, and is documented in NK21-REP-71400-00003, NK21-REP-71400-00004 and NK21-REP-71400-00005. Seismic margin in the event of earthquake is generated as per DPT-PDE-00017, and is	IC

Article No.	Clause Requirement	Assessment	Compliance Category
	one or more of the units where there are multiple units at a site. Human-induced external events that are considered in deterministic safety analysis include: • aircraft or missile impacts • explosions at nearby industrial facilities or transportation systems • release of toxic or corrosive chemicals from nearby industrial facilities or transportation systems • electromagnetic interference	assessed in NK21-REP-20091-00001. Bruce Power has identified in NK21-CORR-00531-09969 its plans for assessment of tornados and external flooding.	
4.2.2.5	Combinations of events (which may occur either simultaneously or sequentially while restoring the plant to a stable state) should be considered. Types of combinations include: • multiple independent failures in equipment important to safety • failure of a process system and system important to safety • multiple process system failures • equipment failures and operator errors • common-cause events and operator errors Examples of event combinations include: • loss of coolant with subsequent loss of station electrical power, including station blackout • loss of coolant with loss of containment cooling • small loss-of-coolant accidents (LOCAs) with failure of primary or secondary depressurization • main steam line break with failure of the operator to initiate a backup cooling system	The one aspect of this clause applicable to Hazard Analysis is that of common-cause events and operator errors. Hazards assessed deterministically such as the Bruce A Fire Safe Shutdown Assessment (NK21-REP-71400-00004) and Seismic Margin Assessment (NK21-REP-20091-00001) do not consider the initiating hazard in combination with operator events. The role of the operator is considered only in the probabilistic assessment of external events.	IC

Article No.	Clause Requirement	Assessment	Compliance Category
4.4.1	The analysis shall provide the appropriate level of confidence in demonstrating conformity with the acceptance criteria. To achieve the appropriate level of confidence, the safety analysis shall: 1. be performed by qualified analysts in accordance with an approved QA process 2. apply a systematic analysis method 3. use verified data 4. use justified assumptions 5. use verified and validated models and computer codes 6. build in a degree of conservatism 7. be subjected to a review process Guidance Section 4.4 mainly addresses analysis methods and assumptions for the deterministic safety analysis of AOOs and DBAs for Level 3 defence in depth. Similar analysis methods and assumptions can be applied for Levels 2 and 4 defence in depth (with appropriate levels of conservatism). Certain conservative rules, such as the single-failure criterion, are not applied in Level 2 and Level 4 analyses. The safety analyst has the option of selecting safety analysis methods and assumptions, as long as the regulatory requirements and expectations are satisfied. The selection of the safety analysis methods and assumptions should be such that the appropriate level of confidence can be achieved in the analysis results.	Generally, the discussion of methods and assumptions to be used for Deterministic Safety Analysis is not applicable to Hazards Analysis: the more relevant guidance for Hazards Analysis is found in CNSC REGDOC-2.5.2 Section 9.3. Some procedural guidance for the conduct of Seismic Margin Assessment is provided in DPT-PDE-00017; and for Fire Hazard Assessment is provided in DPT-PDE-00027, DPT-PDE-00028, DPT-PDE-00029 and DPT-PDE-00030.	RNA
4.4.4.2	The analysis should take into account consequential failures that may occur as a result of an initiating event. Any failures that occur as a consequence of the initiating	Equipment not qualified for specific accident conditions are not credited in hazards analysis.	C

Article No.	Clause Requirement	Assessment	Compliance Category
	event are part of that event and are not considered to be a single failure for the purpose of safety analysis. For example, equipment that is not qualified for specific accident conditions should be assumed to fail unless its normal operation leads to more conservative results.		

B.2. CNSC REGDOC-2.5.2, Design of Reactor Facilities: Nuclear Power Plants

In support of the review tasks listed in Section 5 relevant clauses of CNSC REGDOC-2.5.2 have been assessed in Table B2. A more detailed assessment is performed in "Safety Factor 1 – Plant Design".

Table B2: CNSC REGDOC-2.5.2, Design of Reactor Facilities: Nuclear Power Plants

Article No.	Clause Requirement	Assessment	Compliance Category
4.2.3	To demonstrate achievement of the safety objectives, a comprehensive hazard analysis, a deterministic safety analysis, and a probabilistic safety assessment shall be carried out. These analyses shall identify all sources of exposure, in order to evaluate potential radiation doses to workers at the plant and to the public, and to evaluate potential effects on the environment. The safety analyses shall examine plant performance for: 1. normal operation 2. AOOs 3. DBAs 4. BDBAs, including DECs (DECs could include severe accident conditions) Based on these analyses, the capability of the design to withstand PIEs and accidents shall be confirmed, the effectiveness of the items important to safety demonstrated, and requirements for emergency response established. The results of the safety analyses shall be fed back into the design. The safety analyses are discussed in further detail in section 9.0.	The comprehensiveness of the Hazard Analysis is covered in detail in the assessment against clause 9.3	RNA
5.7	Design documentation shall include information to demonstrate the adequacy of the design and shall be used	The degree to which the design documentation demonstrates adequacy of the design, including	RNA

Article No.	Clause Requirement	Assessment	Compliance Category
	for procurement, construction, commissioning and safe operation, including maintenance, aging management, modification and eventual decommissioning of the NPP. The design documentation shall include: 1. design description 2. design requirements 3. classification of SSCs 4. description of plant states 5. security system design, including a description of physical security barriers and cyber security programs 6. operational limits and conditions 7. identification and categorization of initiating events 8. acceptance criteria and derived acceptance criteria 9. deterministic safety analysis 10. probabilistic safety assessment (PSA) 11. hazard analysis Guidance A suite of design documentation should be developed, following the establishment of an overall baseline, listing all key design documents. Design documents should be contained in a logical and manageable framework. For additional guidance on derived acceptance criteria, refer to CNSC regulatory document REGDOC-2.4.1, Deterministic Safety Analysis. Additional information Additional information may be found in: •CNSC, RD/GD-369, Licence Application Guide: Licence to Construct a Nuclear Power Plant, Ottawa, Canada, 2011. •CNSC, REGDOC-2.4.1, Deterministic Safety Analysis, Ottawa, Canada, 2014.	against hazards, is assessed more fully in SFR1. With respect to SFR7, the Bruce A design documentation does include Hazard Analysis. The detailed hazard analysis of protection against fire is documented in NK21-REP-71400-00003, NK21-REP-71400-00004 and NK21-REP-71400-00005. Seismic margin in the event of earthquake is assessed in NK21-REP-20091-00001. Other internal and external hazards are assessed in RABA-0804.	
6.5	The design shall include adequate provision for an	The one clause portion relevant to SF7 is paragraph	RNA

Article No.	Clause Requirement	Assessment	Compliance Category
	appropriate exclusion zone. The appropriateness of the exclusion zone shall be based on several factors, including: 1. evacuation needs 2. land usage needs 3. security requirements 4. environmental factors Guidance The exclusion zone for NPPs in Canada has been typically defined as 914 metres from the reactor building. Rather than prescribe a particular size for the exclusion zone, this regulatory document specifies factors that must be considered in establishing an appropriate size, including evacuation needs, land usage needs, security requirements and environmental factors. Evacuation needs The design should take into account emergency response requirements based on the size of the exclusion zone and the facilities and infrastructures that are within the zone. The exclusion zone boundary should be defined with consideration for the capabilities of onsite and offsite emergency response. Environmental factors which can affect the response times should be taken into consideration. The design also considers projected changes over time in land use and population density, which could adversely affect response times, or the ability to shelter or evacuate persons from both the site itself and associated emergency planning regions. Evacuation needs are generally based on existing provincial nuclear emergency response plans. Land usage needs The design should ensure that the exclusion zone is large	3 under "Security Requirements": "In establishing the radius of the exclusion zone boundary, the design should take into account: • facility robustness against natural and human induced external hazards (including malevolent acts)" This clause is assessed in detail under SF1.	

Article No.	Clause Requirement	Assessment	Compliance Category
	enough to accommodate the site for the nuclear plant (accounting for the full number of units postulated to be built at the site, whether or not they would be built immediately). The design activities should seek to optimize land usage by the plant as part of determining the exclusion zone. Security requirements The design should provide security requirements based on the size of the exclusion zone, the facilities and infrastructures that are within the zone, and the design of the facility. Generally, a larger exclusion zone would require more security capabilities, in order to avoid a longer response time. Physical characteristics of the site itself (which include geographical characteristics, such as proximity to elevated land) also play a role in determining these requirements. The design authority may decide to mitigate these risks while maintaining a smaller exclusion zone, by choosing highly robust facility designs, applying engineered security measures to the site, and having a well-designed security program. These engineered measures should be described. In establishing the radius of the exclusion zone boundary, the design should take into account: •the site selection and threat assessment report •facility robustness against natural and human induced external hazards (including malevolent acts) •the capability of the onsite security program, along with any offsite security resources that will supplement the onsite security program In each of the above parameters, the design should take into account projected changes over time in land use and population density, which could adversely affect that		

Article No.	Clause Requirement	Assessment	Compliance Category
	parameter. The design should be such that the exclusion zone, as established at the design stage, will be sustainable for the full lifecycle of the facility. The acceptability of the information to be provided in support of the above is discussed in section 7.22 of this document. Environmental factors Environmental factors which may have an impact on the size of the exclusion zone include local meteorological conditions which could affect the radiological dose received by members of the public. The design authority may use generic site data using conservative assumptions regarding meteorological conditions in the absence of a specific site. The Radiation Protection Regulations establish an effective dose limit of 1 mSv per year for members of the public. This limit implies that a hypothetical member of the public who lives at the exclusion zone boundary for 1 year (since no permanent dwelling is permitted within the exclusion zone) would not accumulate a dose of more than 1 mSv from normal operation of the NPP. Additional information may be found in: •CNSC, RD-346, Site Evaluation for New Nuclear Power Plants, Ottawa, Canada, 2008.		
7.4	The design for the NPP shall apply a systematic approach to identifying a comprehensive set of postulated initiating events, such that all foreseeable events with the potential for serious consequences or with a significant frequency of occurrence are anticipated and considered. Postulated initiating events can lead to AOOs, DBAs or BDBAs, and include credible failures or malfunctions of SSCs, as well as operator errors, common-cause internal	The comprehensiveness of the Hazard Analysis is covered in detail in the assessment against clause 9.3	RNA

Article No.	Clause Requirement	Assessment	Compliance Category
	hazards, and external hazards. For a site with multiple units, the design shall take due account of the potential for specific hazards simultaneously impacting several units on the site. Guidance The postulated initiating events (PIEs) are identified using engineering judgment and deterministic and probabilistic assessment. A justification of the extent of usage of deterministic safety analyses and probabilistic safety analyses should be provided, in order to show that all foreseeable events have been considered. Sufficient information should be provided regarding the methods used to identify PIEs, their scope and classification. In cases where the identification methods have made use of analytical tools (e.g., master logic diagrams, hazard and operability analysis, failure modes and effect analysis), detailed information is expected to be presented. A systematic approach to event classification should consider all internal and external events, all normal operating configurations, various plant and site conditions, and failure in other plant systems (e.g., storage for irradiated fuel, and tanks for radioactive substances). The design should take into account failure of equipment that is not part of the NPP, if the failure has a significant impact on nuclear safety. CNSC REGDOC-2.4.1, Deterministic Safety Analysis and REGDOC-2.4.2, Probabilistic Safety Assessments, provide the requirements and guidance for establishing the scope of PIEs, and for classifying the PIEs in accordance with their anticipated frequencies, and other factors, as appropriate.		

Article No.	Clause Requirement	Assessment	Compliance Category
	For further information on the safety analysis for the identified PIEs, refer to section 9.0 of this document. Additional information Additional information may be found in: •CNSC, REGDOC-2.4.1, Deterministic Safety Analysis, Ottawa, Canada, 2014.		
7.4.1	SSCs important to safety shall be designed and located in a manner that minimizes the probability and effects of hazards (e.g., fires and explosions) caused by external or internal events. The plant design shall take into account the potential for internal hazards, such as flooding, missile generation, pipe whip, jet impact, fire, smoke, and combustion by-products, or release of fluid from failed systems or from other installations on the site. Appropriate preventive and mitigation measures shall be provided to ensure that nuclear safety is not compromised. Internal events which the plant is designed to withstand shall be identified, and AOOs, DBAs and DECs shall be determined from these events. The possible interaction of external and internal events shall be considered, such as external events initiating internal fires or floods, or that may lead to the generation of missiles. Guidance The design should take into account specific loads and environmental conditions (temperature, pressure, humidity, radiation) imposed on structures or components by internal hazards. The following potential initiators of flooding should be considered: •leaks and breaks in pressure-retaining components	The comprehensiveness of protection against internal hazards is covered in detail in SF1, and in the SF7 assessment against clause 9.3.	RNA

Article No.	Clause Requirement	Assessment	Compliance Category
	•flooding by water from neighbouring buildings •spurious actuation of the fire-fighting system •overfilling of tanks •failures of isolating devices The design considers internal missiles which can be generated by failure of rotating components (such as turbines), or by failure of pressurized components. For those potential missiles considered to be credible, the following actions should be taken: •a realistic assessment is made of the postulated missile size and energy, and its potential trajectories •potentially impacted components associated with systems required to achieve and maintain a safe shutdown state are identified •a loss of these potentially impacted components is evaluated to determine if sufficient redundancy remains to achieve and maintain a safe shutdown state The civil design takes into account loads generated by internal hazards in the environmental loading category consistent with section 7.15.		
7.4.2	All natural and human-induced external hazards that may be linked with significant radiological risk shall be identified. External hazards which the plant is designed to withstand shall be selected, and classified as DBAs or DECs. Various interactions between the plant and the environment, such as population in the surrounding area, meteorology, hydrology, geology and seismology shall be identified during the site evaluation and environmental assessment processes. These interactions shall be taken into account in determining the design basis for the NPP. Applicable natural external hazards shall include such	The comprehensiveness of protection against external hazards is covered in detail in SF1, and in the SF7 assessment against clause 9.3.	RNA

Article No.	Clause Requirement	Assessment	Compliance Category
	hazards as earthquakes, droughts, floods, high winds, tornadoes, tsunami, and extreme meteorological conditions. Human induced external hazards shall include those that are identified in the site evaluation, such as potential aircraft crashes, ship collisions, and terrorist activities. Guidance The design should take into account all site characteristics that may affect the safety of the plant, and should identify the following: •site-specific hazard evaluation for external hazards (of human or natural origin) •design assumptions or values, in terms of recurrence probability of external hazards •definition of the design basis for external hazards •collection of site reference data for the plant design (geotechnical, seismological, hydrological, hydrogeological and meteorological) •evaluation of the impact of the site-related issues to be considered in the application, concerning emergency preparedness and accident management •arrangements for the monitoring of site-related parameters throughout the life of the plant Natural external hazards other than earthquakes may be categorized as: •hazards that have potential to damage SSCs important to safety •hazards that are evaluated and screened out Natural external hazards considered in the design process should include: •earthquakes •extreme meteorological conditions of temperature, snow, freezing rain, hail, frost, subsurface freezing and drought		

Article No.	Clause Requirement	Assessment	Compliance Category
	•floods due to tides, tsunamis, seiches, storm surges, precipitation, waterspouts, dam forming and dam failures, snow melt, land slides into water bodies, channel changes and work in the channel •cyclones (e.g., hurricanes, tornadoes) and straight winds •abrasive dust and sand storms •lightning •volcanoes (site is sufficiently remote from volcanoes) •biological phenomena •collision of floating debris (e.g., ice, logs) with accessible safety-related structures, such as water intakes and ultimate heat sink components •geomagnetic storm (solar flare and electromagnetic pulses) •combinations of extreme weather conditions that could reasonably be assumed to occur at the same time Natural external hazards that are evaluated and screened out may be based on the following criteria: •a phenomenon that occurs slowly or with adequate warning with respect to the time required to take appropriate protective action •a phenomenon which in itself has no significant impact on the operation of an NPP and its design basis •an individual phenomenon which has an extremely low probability of occurrence •the NPP is located sufficiently distant from or above the postulated phenomenon (e.g., fire, flooding) •a phenomenon that is already included or enveloped by design in another phenomenon (e.g., storm-surge and seiche included in flooding or accidental small aircraft crash enveloped by tornado loads) Human induced hazards considered in the design process should include:		

Article No.	Clause Requirement	Assessment	Compliance Category
	•aircraft crashes (general aviation) •explosions (deflagrations and detonations) with or without fire, with or without secondary missiles, originating from offsite and onsite sources (but external to safety-related buildings), such as hazardous or pressurized materials in storage, transformers, pressure vessels, or high- energy rotating equipment •release of hazardous gases (asphyxiant, toxic) from offsite and onsite storage •release of corrosive gases and liquids from offsite and onsite storage •release of radioactive material from offsite sources •fire generated from offsite sources (mainly for its potential for generating smoke and toxic gases) •collision of ships or floating debris with accessible safety-related structures, such as water intakes and ultimate heat sink components •collision of vehicles at the site with SSCs •electromagnetic interference from off the site (e.g., from communication centres and portable phone antennas) and on the site (e.g., from the activation of high voltage electrical switchgear and from unshielded cables) •any combination of the above, as a result of a common initiating hazard (such as an explosion with fire and release of hazardous gases and smoke) Malevolent acts including aircraft crashes are considered separately, in section 7.22. For civil design, human induced hazards which are classified as DBAs are taken into account as loads in the abnormal or extreme environmental load category, consistent with section 7.15. Less frequent human induced hazards are considered part of DECs.		

Article No.	Clause Requirement	Assessment	Compliance Category
	Additional information Additional information may be found in: •American Nuclear Society (ANS), 2.3, Estimating Tornado, Hurricane, and Extreme Straight Line Wind Characteristics at Nuclear Facility Sites, La Grange Park, Illinois, 2011. •CNSC, RD-346, Site Evaluation for New Nuclear Power Plants, Ottawa, Canada, 2008. •IAEA, NS-G-3.1, External Human Induced Events in Site Evaluation for Nuclear Power Plants, Vienna, 2002. •National Research Council (NRC), National Building Code of Canada, Ottawa, Canada, 2010.		
7.12.1	Suitable incorporation of operational procedures, redundant SSCs, physical barriers, spatial separation, fire protection systems, and design for fail-safe operation shall achieve the following general objectives: 1. prevent the initiation of fires 2. limit the propagation and effects of fires that do occur by: a. quickly detecting and suppressing fires to limit damage b. confining the spread of fires and fire by-products that have not been extinguished 3. prevent loss of redundancy in safety and safety support systems 4. provide assurance of safe shutdown 5. ensure that monitoring of safety-critical parameters remains available 6. prevent exposure, uncontrolled release, or unacceptable dispersion of hazardous substances, nuclear material, or radioactive material, due to fires 7. prevent the detrimental effects of event mitigation	Guidance for documenting protection against fire hazard is provided in DPT-PDE-00027, DPT-PDE-00028 and DPT-PDE-00029. The extent to which the Bruce A design achieves all objectives detailed in this clause is documented in NK21-REP-71400-00003, NK21-REP-71400-00004 and NK21-REP-71400-00005.	C

Article No.	Clause Requirement	Assessment	Compliance Category
	efforts, both inside and outside of containment 8. ensure structural sufficiency and stability in the event of fire Buildings or structures shall be constructed using non-combustible or fire retardant and heat resistant material. Fire is considered an internal hazard. The essential safety functions shall be available during a fire. Fire suppression systems shall be designed and located such that rupture, or spurious or inadvertent operation, will not significantly impair the capability of SSCs important to safety. Guidance Effective fire protection is achieved by: •fire protection features such as programs and procedures, fire prevention, fire detection, fire warning, emergency communication, fire by-product management, fire suppression and fire containment, non-combustible construction, seismic and environmental qualification of fire protection equipment •the use of physical barriers to segregate redundant SSCs important to safety The design should address protection from fire by demonstrating that a defence in depth approach has been implemented. Supporting documents are expected to include a comprehensive design report, code compliance review, a fire hazard assessment, fire safe shutdown analysis, and a fire protection program. An independent third-party review of the design assessing compliance against the applicable fire codes and standards used in the design for protection from fires and explosions should be performed. The review should provide a definitive		

Article No.	Clause Requirement	Assessment	Compliance Category
	statement that the design conforms to the identified codes and standards, meets good engineering practices, and achieves fire protection objectives. The design should comply with the requirements of the following codes and standards: •CSA Group, N293, Fire protection for nuclear power plants, Toronto, Canada. •NRC, National Building Code of Canada, Ottawa, Canada, 2010. •NRC, National Fire Code of Canada, Ottawa, Canada, 2010. Although CSA N293 is considered acceptable to provide technology-neutral design criteria, it does not fully address some fire safety aspects, such as: •operator-initiated manual actions •associated fire safe shutdown circuit analysis •multiple spurious operations Guidance on the above fire safety aspects is provided in: •U.S. NRC, NUREG-1852, Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire, 2007. •Nuclear Energy Institute, NEI 00-01, Guidance for Post-Fire Safe Shutdown Circuit Analysis, Washington, D.C., 2005. Additional information may be found in: •IAEA, NS-G-2.1, Fire Safety in Operation of Nuclear Power Plants, Vienna, 2000. •IAEA, Safety Report Series No. 8, Preparation of Fire Hazard Analysis for Nuclear Power Plants, Vienna, 1998. •IAEA, NS-G-1.7, Protection Against Internal Fires and Explosions in the Design of Nuclear Power Plants, Vienna, 2004. •National Fire Protection Association (NFPA), Fire		

Article No.	Clause Requirement	Assessment	Compliance Category
	Protection Handbook, Quincy, Massachusetts, 2008. •NFPA, 805, Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, Quincy, Massachusetts, 2010. •NFPA, 804, Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants, Quincy, Massachusetts, 2010. •NEI, 00-01, Guidance for Post-Fire Safe Shutdown Circuit Analysis, Washington, D.C., 2005. •NEI, 04-02, rev. 1, Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c), Washington, D.C., 2005. •Society of Fire Protection Engineers (SFPE), SFPE Handbook of Fire Protection Engineering, Bethesda, Maryland, 2008. •U.S. NRC, NUREG/CR-6850, EPRI 1011989, Fire Probabilistic Risk Assessment Methods Enhancements, Washington, D.C., 2010. •U.S. NRC, NUREG-0800, section 9.5.1.1, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR edition - Fire Protection Program, Washington, D.C., 2009. •U.S. NRC, Regulatory Guide 1.189, Fire Protection for Operating Nuclear Power Plants, Washington, D.C., 2009. •U.S. NRC, NUREG-1852, Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire, Washington, D.C., 2007.		
7.12.2	The design shall provide protection to workers and the public from event sequences initiated by fire or explosion in accordance with established radiological, toxicological, and human factors criteria so that the following objectives are achieved:	Guidance for documenting protection against fire hazard is provided in DPT-PDE-00027, DPT-PDE-00028 and DPT-PDE-00029. The extent to which the Bruce A design achieves all objectives detailed in this clause is documented in	C

Article No.	Clause Requirement	Assessment	Compliance Category
	1. Persons not intimate with the initial event (including the public, occupants, and emergency responders) are protected from injury and loss of life. 2. Persons intimate with the initial event have a low probability of injury or death. To demonstrate that the above life safety objectives have been achieved, the design shall provide: 1. effective and reliable means of fire detection in all areas 2. effective and reliable means of emergency notification, including the nature of the emergency and protective actions to be taken 3. multiple and separate safe egress routes from any area 4. easily accessible exits 5. effective and reliable identification and illumination of egress routes and exits 6. sufficient exiting capacity for the number of workers (taking into account the emergency movement of crowds) 7. protection of workers from fires and fire by-products (i.e., combustion products, smoke, heat etc.) during egress and in the areas of refuge 8. protection of workers performing plant control and mitigation functions during or following a fire 9. adequate supporting infrastructure (lighting, access etc.) for workers to perform emergency response, plant control, and mitigation activities during or following a fire 10. sufficient structural integrity and stability of buildings and structures to ensure the safety of workers and emergency responders during and after a fire 11. protection of workers from the release or dispersion of hazardous substances, radioactive material, or nuclear material as a result of fire Guidance	NK21-REP-71400-00003, NK21-REP-71400-00004 and NK21-REP-71400-00005.	

Article No.	Clause Requirement	Assessment	Compliance Category
	The National Building Code of Canada (NBCC) and the National Fire Code of Canada (NFCC) are objective-based national model codes. The provisions of the NBCC and NFCC are considered the minimum acceptable measures for meeting the objectives of safety, health, structural protection, and fire protection of buildings. As such, additional fire protection measures may be required to meet the regulatory requirements detailed in this regulatory document. Additional fire safety provisions are usually assessed and documented in the code compliance and fire hazard assessment, as required by CSA N293, Fire protection for nuclear power plants.		
7.15.1	The NPP design shall specify the required performance for the safety functions of the civil structures in operational states, DBAs and DECs. Civil structures important to safety shall be designed and located so as to minimize the probabilities and effects of internal hazards such as fire, explosion, smoke, flooding, missile generation, pipe whip, jet impact, or release of fluid due to pipe breaks. External hazards such as earthquakes, floods, high winds, tornadoes, tsunamis, and extreme meteorological conditions shall be considered in the design of civil structures. Settlement analysis and evaluation of soil capacity shall include consideration of the effects of fluctuating ground water on the foundations, and identification and evaluation of potential liquefiable soil strata and slope failure. Civil structures important to safety shall be designed to meet the serviceability, strength, and stability requirements for all possible load combinations under the categories of normal operation, AOO, DBA and DEC conditions, including	See discussion under clauses 7.4.1, 7.4.2, 5.7. Also assessed under SF1.	RNA

Article No.	Clause Requirement	Assessment	Compliance Category
	external hazards. The serviceability considerations shall include, without being limited to, deflection, vibration, permanent deformation, cracking, and settlement. The design specifications shall also define all loads and load combinations, with due consideration given to the probability of concurrence and loading time history. Environmental effects shall be considered in the design of civil structures and the selection of construction materials. The choice of construction material shall be commensurate with the designed service life and potential life extension of the plant. The plant safety assessment shall include structural analyses for all civil structures important to safety. Guidance The design authority should provide the design principles, design basis requirements and criteria, and applicable codes and standards, design and analysis procedures, the assumed boundary conditions and the computer codes used in the analysis and design. All internal and external hazard loads are specified in section 7.4. Earthquake design input loads and impacts of malevolent acts, including large aircraft crash can be found in sections 7.13 and 7.22, respectively. Load categories corresponding to the plant states are defined in this section so as to demonstrate structural performances as follows: •normal condition loads which are expected during the assumed design life of the NPP •AOO loads (or severe environmental loads) •DBA loads (or abnormal or extreme environmental loads)		

Article No.	Clause Requirement	Assessment	Compliance Category
	•DEC loads (or beyond-design loads) The design should identify all DEC loads considered in the structure design and provide the assessment methodology and acceptance criteria. The structural design should withstand, accommodate or avoid foundation settlement (total and differential), according to its performance requirements. The structural design should consider the impact of aging on the structure and its material. The design should include sufficient safety margins for the buildings and structures that are important to safety. The physical and material description of each civil structure and its base slab should include: •the type of structure, and its structural and functional characteristics •the geometry of the structures, including sketches showing plan views at various elevations and sections (at least two orthogonal directions) •the relationship between adjacent structures, including any separation or structural ties •the type of base slab and its arrangement with the methods of transferring horizontal shears (such as those seismically induced) to the foundation media Containment structure The design should specify the safety requirements for the containment building or system, including, for example, its structural strength, leak tightness, and resistance to steady-state and transient loads (such as those arising from pressure, temperature, radiation, and mechanical impact) that could be caused by postulated internal and external hazards. In addition, the design should specify the safety requirements and design features for the containment		

Article No.	Clause Requirement	Assessment	Compliance Category
	internal structures, (such as the reactor vault structure, the shielding doors, the airlocks, and the access control and facilities). The design of the containment structure should include: •base slab and sub-base •containment wall and dome design •containment wall openings and penetrations •pre-stressing system •containment liner and its attachment method The design pressure of the containment building should be determined by increasing by at least 10% the peak pressure that would be generated by the DBA (refer to clause 4.49 of IAEA NS-G-1.10, Design of Reactor Containment Systems for Nuclear Power Plants). Ultimate internal pressure capacity should be provided for the containment building structures including containment penetrations. If the containment building foundation is a common mat slab which is not separated from the other buildings foundation, the impact should be evaluated. Concrete containment structures should be designed and constructed in accordance with the CSA N287 series, as applicable: •N287.1, General Requirements for Concrete Containment Structures for CANDU Nuclear Power Plants, for general requirements in documentation of design specification and design reports •N287.2, Material Requirements for Concrete Containment Structures for CANDU Nuclear Power Plants, for material •N287.3, Design Requirements for Concrete Containment Structures for CANDU Nuclear Power Plants for design •N287.4, Construction, Fabrication and Installation		

Article No.	Clause Requirement	Assessment	Compliance Category
	Requirements for Concrete Containment Structures for CANDU Nuclear Power Plants, and N287.5, Examination and Testing Requirements for Concrete Containment Structures for Nuclear Power Plants, for containment construction and inspection •N287.6, Pre-operational proof and leakage rate testing requirements for concrete containment structures for nuclear power plants, for pressure test before operation Steel containment structures should be designed according to the ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NE, Class MC Components or equivalent standard. Stability of the containment vessel and appurtenances should be evaluated using ASME Code Case N-284-1, Metal Containment Shell Buckling Design Methods, Section III, Division 1, Class MC. For other requirements on the design of containment structures, refer to section 8.6.2 of this regulatory document. Safety-related structures The safety-related structures other than the containment should be designed and constructed in accordance with CSA N291, Requirements for safety-related structures for CANDU nuclear power plants. The design of other safety-related structures should include: •internal structures of reactor building •service (auxiliary) building •fuel storage building •control building •diesel generator building •containment shield building, if applicable •other safety-related structures defined by the design •turbine building (for boiling water reactor)		

Article No.	Clause Requirement	Assessment	Compliance Category
	Additional information Additional information may be found in: •American Concrete Institute (ACI), 349-06, Code Requirements for Nuclear Safety-Related Concrete Structures & Commentary, Farmington Hills, Michigan, 2007. •ASME, Boiler and Pressure Vessel Code (BPVC) Section III, Division 2, Section 3, Code for Concrete Containments, New York, 2010. •IAEA, NS-G-1.10, Design of Reactor Containment Systems for Nuclear Power Plants, Vienna, 2004. •U.S. NRC, NUREG/CR-6486, Assessment of Modular Construction for Safety-Related Structures at Advanced Nuclear Power Plants, Washington, D.C., 1997. •U.S. NRC, Regulatory Guide 1.76, Design Basis Tornado and Tornado Missiles for Nuclear Power Plants, Washington, D.C., 2007. •U.S. NRC, Regulatory Guide 1.91, Evaluations of Explosions Postulated to occur on Transportation Routes near Nuclear Power Plants, Washington, D.C., 1978. •U.S. NRC, NUREG-0800, Section 3.8.1, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition - Concrete Containment, Washington, D.C., 2007.		
9.3	Hazard analysis shall collect and evaluate information about the NPP to identify the associated hazards and determine those that are significant and must be addressed. A hazard analysis shall demonstrate the ability of the design to effectively respond to credible common-cause events. As discussed in section 9.1, the first step of the hazard analysis is to identify PIEs. For each common-cause PIE, the hazard analysis shall identify:	Paragraph 1: Section 2.5 of NK21-SR-01320-00002 describes design criteria for seismic events, missile protection, effects of pipe rupture and environmental qualification. All external and most internal hazards that could potentially serve as the initiator of common-cause events were subjected to a first level of screening in	IC

Article No.	Clause Requirement	Assessment	Compliance Category
	1. applicable acceptance criteria (i.e., the success path criteria) 2. the hazardous materials in the plant and at the plant site 3. all qualified mitigating SSCs credited during and following the event all non-qualified safety or safety support systems are assumed to fail, except in cases where their continued operation would result in more severe consequences 4. operator actions and operating procedures for the event 5. plant or operating procedure parameters for which the event is limiting The hazard analysis shall confirm that: 1. the plant design incorporates sufficient diversity and separation to cope with credible common-cause events 2. credited SSCs are qualified to survive and function during and following credible common- cause events, as applicable 3. the following criteria are met: a. the plant can be brought to a safe shutdown state b. the integrity of the fuel in the reactor core can be maintained c. the integrity of the reactor coolant pressure boundary and containment can be maintained d. safety-critical parameters can be monitored by the operator The hazard analysis report shall include the findings of the analysis and the basis for those findings. This report shall also: 1. include a general description of the physical characteristics of the plant that outlines the prevention and protection systems to be provided 2. include the list of safe shutdown equipment	order to eliminate ones which are inapplicable to Bruce A or with too low a frequency. The first level screening report was submitted to CNSC staff in NK21-CORR-00531-09809. The remaining hazards were submitted to a second level screening (submitted in NK21-CORR-00531-10848) which eliminated from consideration for further assessment all but the following events: *Fire *Earthquake; *Tornado; *External flooding and extreme waves. The detailed hazard analysis of protection against fire is documented in NK21-REP-71400-00003, NK21-REP-71400-00004 and NK21-REP-71400-00005. Seismic margin in the event of earthquake is assessed in the SMA NK21-REP-20091-00001. Bruce Power has identified in NK21-CORR-00531-09969 its plans for assessment of tornados and external flooding. Paragraph 2: 1. The overriding acceptance criterion for events covered by the hazards assessment is that it must be demonstrated that the reactors can be shut down, cooled and that containment must be effective. For each hazard considered, other derived criteria are developed. For example, for an earthquake, it should be shown that integrity of the reactor primary coolant boundary and containment are maintained. The Seismic Margin Assessment has concluded that	

Article No.	Clause Requirement	Assessment	Compliance Category
	3. define and describe the characteristics associated with hazards for all areas that contain hazardous materials 4. describe the performance criteria for detection systems, alarm systems, and mitigation systems, including requirements such as seismic or environmental qualification 5. describe the control and operating room areas and the protection systems provided for these areas, including additional facilities for maintenance and operating personnel 6. describe the operator actions and operating procedures of importance to the given analysis 7. identify the plant parameters for which the event is limiting 8. explain the inspection, testing, and maintenance parameters needed to protect system integrity 9. define the emergency planning and coordination requirements for effective mitigation, including any necessary measures to compensate for the failure or inoperability of any active or passive protection system or feature Guidance The objective of the hazard analysis is to determine the adequacy of protection of the NPP against internal and external hazards, while taking into account the plant design and site characteristics. To ensure the availability of required safety functions and operator actions, all the SSCs important to safety (including the main control room, secondary control room and emergency support facilities) should be adequately protected against relevant internal and external hazards. The hazard analysis should establish a list of relevant internal and external hazards that may affect plant safety. For the relevant hazards, the review should demonstrate, by	the earthquake will not result in a large LOCA nor would the steam lines fail. It also noted that small leaks from the PHT or failure of some small diameter piping could not be excluded and judged that the combined leakage would be equivalent to a 1" diameter break. Thus, the net result of an earthquake would be a small LOCA that could be dealt with by the systems in the success path. The applicable acceptance criteria are also summarized in Section 2.5 of NK21-SR-01320-00002. 2. Bruce Power's Environmental Safety Management program (BP-PROG-00.02) requires that all hazardous materials in the plant and on the site be identified so that their impact on the environment can be assessed. Thus, all of the hazardous material can be identified as required by this clause for any future hazards analyses. 3. Section 2.5 of NK21-SR-01320-00002 identifies SSCs designed for seismic events, missile protection, effects of pipe rupture and environmental qualification. Section 2.5.4.2 of the same reference lists the systems that are subject to environmental qualification. Only qualified systems are credited. 4. Section 1.3 of NK21-SR-01320-00003 summarizes operator credits for various initiating events. Emergency Operating Procedures and the Abnormal Incidents Manual NK21-OM-09034 address DBAs regarding of the hazard initiating the DBA.	

Article No.	Clause Requirement	Assessment	Compliance Category
	using deterministic and probabilistic techniques, that the probability or consequences of the hazard are sufficiently low so that no specific protective measures are necessary, or that the preventive and mitigating measures against the hazard are adequate. All internal and external hazards are considered as part of PIEs. The hazards that make an insignificant contribution to plant risk can be screened out from the detailed analysis; however, the rationale for this screening should be provided. The remaining PIEs constitute the scope of the hazard analysis. The design should specify design-basis hazards, establishing clear criteria. The design-basis hazards should be analyzed using the deterministic safety analysis rules and criteria provided in section 9.4. Such analysis should also demonstrate the adequacy of the complementary design features in mitigating radiological consequences of design extension conditions. The hazard analysis should demonstrate that the design incorporates sufficient safety margins. Additional information Additional information may be found in: •CNSC, RD-346, Site Evaluation for New Nuclear Power Plants, Ottawa, Canada, 2008. •CNSC, RD/GD-369, Licence Application Guide: Licence to Construct a Nuclear Power Plant, Ottawa, Canada, 2011. •CSA Group, N293, Fire protection for nuclear power plants, Toronto, Canada, 2012. •CSA Group, N289.4, Testing procedures for seismic qualification of nuclear power plants, Toronto, Canada. •IAEA, NS-G-3.3, Evaluation of Seismic Hazards for Nuclear Power Plants, Vienna, 2002. •IAEA, NS-G-1.5, External Events Excluding Earthquakes in	For fires, the majority of the actions are via automated systems. However, the Fire Safe Shutdown Assessment (FSSA) (NK21-REP-71400-00004] identifies fire zones where manual actions could be credited, and identifiest procedures needed to be updated to incorporate these operator actions. For the SMA NK21-REP-20091-00001, numerous operator actions are required. One of the objectives of the SMA was "to select the success path for which it will be the most cost-effective to demonstrate adequate seismic margin, yet be compatible with plant operator training and established procedures." Path success is defined as the ability to achieve and maintain a stable hot or cold shutdown condition for at least a 72 hour period following the seismic event. 5. Section 1.5 of NK21-SR-01320-00003 provides details of limiting parameters of all intiating events regardless of the hazard causing the accident. Paragraph 3: 1. As noted in the Bruce 1&2 ISR review against Darlington-DG-38-03650-2A (NK21-CORR-00531-04339), Bruce A relies heavily on EQ and SMA approaches to demonstrate that one line of defence is available for common mode incidents. One line of defence has been accepted by the CNSC as a practicable approach for older plants to take towards dealing with common mode incidents 2. Only SSCs qualified to withstand conditions during	

Article No.	Clause Requirement	Assessment	Compliance Category
	the Design of Nuclear Power Plants, Vienna, 2003. •IAEA, NS-G-3.1, External Human Induced Events in Site Evaluation for Nuclear Power Plants, Vienna, 2002. •IAEA, NS-G-3.5, Flood Hazard for Nuclear Power Plants on Coastal and River Sites, Vienna, 2003. •IAEA, NS-G-3.4, Meteorological Events in Site Evaluation for Nuclear Power Plants, Vienna, 2003. •IAEA, SSG-18, Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations, Vienna, 2011. •IAEA, NS-G-1.7, Protection Against Internal Fires and Explosions in the Design of Nuclear Power Plants, Vienna, 2004. •IAEA, NS-G-1.11, Protection Against Internal Hazards other than Fires and Explosions in the Design of Nuclear Power Plants, Vienna, 2004. •IAEA, NS-G-1.6, Seismic Design and Qualification for Nuclear Power Plants, Vienna, 2003. •IAEA, SSG-9, Seismic Hazards in Site Evaluation for Nuclear Installations, 2 Vienna, 2010.	and after credible initiating events are credited. 3. The requirements to control, cool and contain the reactor are part of the success path of hazard analysis. Regarding the monitoring of safety-critical parameters, Bruce Power has constructed an SCA for Units 3 and 4, and a separate one for Units 1 & 2. The purpose of these SCAs is to provide an alternate location for control and monitoring of the reactors should the MCR become unavailable. Thus, these parameters can be monitored following a fire. The SMA has shown that the MCR can survive the effects of a DBE and the SCA has been designed to be seismically qualified. Paragraph 4: There is no single Hazard Analysis Report which collects all the noted information in the elements of this paragraph. Instead, the information is listed in documents already cited in the assessment of the preceding paragraphs: NK21-SR-01320-00002, NK21-SR-01320-00003, BP-PROG-00.02, NK21-REP-71400-00004, NK21-REP-71400-00005, NK21-REP-20091-00001, BP-PLAN-00001, NK21-OM-09034.	

B.3. Incremental Clause-by-Clause Assessment of CSA N293-12, Fire Protection for CANDU Nuclear Power Plants

In support of the review tasks listed in Section 5, a code-to-code comparison has been performed for CSA N293-12 to the previous version assessed (CSA N293-07) in Table C1. An incremental verification of these new requirements has been performed in Table B3.

Table B3: Incremental Clause-by-Clause Assessment of CSA N293-12, Fire Protection for CANDU Nuclear Power Plants

Article No.	Clause Requirement	Assessment	Compliance Category
5.2*	The fire protection goals for plants are (a) to minimize the risk of radiological releases to the public that are a result of fire; (b) to protect plant occupants from death or injury due to fire; (c) to minimize economic loss resulting from fire damage to structures, equipment, and inventories; and (d) to minimize the impact of radioactive and hazardous materials on the environment as a result of fire.	The four goals are reflected in the Purpose section of the Bruce Power Fire Safety Management procedure (BP-PLAN-00008)	C
5.6.1	The fire protection assessments shall be prepared for every plant in accordance with the requirements in Clause 11 and shall include at least the following: (a) code compliance review; (b) fire hazard assessment; and (c) fire safe shutdown analysis.	Bruce A has a Fire Safety Assessment (FSA), consisting of a Code Compliance Review (CCR), Fire Hazard Assessment (FHA) and Fire Safe Shutdown Analysis (FSSA). The most recent versions NK21-REP-71400-00003, NK21-REP-71400-00004 and NK21-REP-71400-00005 were submitted to CNSC in NK21-CORR-00531-09479. The CNSC response in NK21-CORR-00531-10758 noted that based on review of all Fire Protection material submitted, the revised FSSA, FHA and CCR for Bruce A were deemed acceptable to meet the requirements of CSA N293 and the Bruce A Power Reactor Operating Licence (PROL) and associated Licence Conditions Handbook.	C

Article No.	Clause Requirement	Assessment	Compliance Category
5.6.2	The fire protection assessments shall be updated as necessary to reflect plant modifications, significant changes in fire hazards, and operating experience.	This is done as required. As demonstration of this, the Bruce A FHA NK21-REP-71400-00003, FSSA NK21-REP-71400-00004 and CCR NK21-REP-71400-00005 comprising the Fire Protection Assessment are currently at revision R05, R06 and R05 respectively.	C
7.4.1	All fire protection systems shall be seismically designed to satisfy the requirements of NFPA 13 and NBCC, except for fire protection systems specified in Clauses 7.4.2 and 7.4.3. The design and installation of fire protection systems specified in Clause 7.4.2 and 7.4.3 shall comply with CSA N289.3. The following seismic categories shall be used to identify the extent to which SSCs are required to remain operational after an earthquake: (a) Seismic Category A - SSCs that must retain their pressure boundary integrity, structural integrity, or passive function (i.e., equipment that does not have an active mechanical function but might have an electrical or load-bearing function) during and following an earthquake. (b) Seismic Category B - SSCs that must retain their pressure boundary integrity, structural integrity, or active function and in addition must remain operable during and following an earthquake. Category B includes equipment that is not part of the pressure boundary but must operate during and following an earthquake.	Seismic Margin Assessment Report NK21-REP-20091-00001 describes the seismic margin assessment performed in order to demonstrate the successful operation and survival of the components and structures necessary to bring the plant to a safe hot or cold shutdown and maintain that condition for 72 hours. A success path equipment list was compiled to identify the specific mechanical and electrical equipment required to maintain seismic integrity of the success path. Per NK21-REP-03611-00006, the portion of the Fire Water System on the seismic success path for Bruce A is seismically qualified to a Review Level Earthquake. Additionally, the following fire protection systems are seismically qualified. Per NK21-DM-71410-001, the pre-action foam system piping in the QPS Diesel Generation Room in the Old Water Treatment Building is designed to remain intact during a seismic event and is seismically qualified to DBE Category A. Class 1 standpipe piping is installed in the essential egress stairwells in the Reactor Auxiliary Bay and are seismically qualified to DBE Category A. Additionally various other sections of fire protection piping adjacent to the ECI piping in the Reactor Auxiliary Bay are seismically qualified to DBE Category A to avoid damage to adjacent safety related	C

Article No.	Clause Requirement	Assessment	Compliance Category
		equipment during a seismic event.	
11.2.1*	The fire protection assessments shall be initiated early in the design of new plants and updated when the plant design is finalized.	This is done as required. As demonstration of this, the Bruce A FHA NK21-REP-71400-00003, FSSA NK21-REP-71400-00004 and CCR NK21-REP-71400-00005 comprising the Fire Protection Assessment are currently at revision R05, R06 and R05 respectively.	C
11.2.2*	The fire protection assessments shall be updated as necessary to reflect plant modifications, significant changes in fire hazards, operating experience, and operational changes.	This is done as required. As demonstration of this, the Bruce A FHA NK21-REP-71400-00003, FSSA NK21-REP-71400-00004 and CCR NK21-REP-71400-00005 comprising the Fire Protection Assessment are currently at revsion R05, R06 and R05 respectively.	C
11.2.3	The fire protection assessments for an operating plant shall be revised or reaffirmed at least once every five years.	Governing procedures DPT-PDE-00027, DPT-PDE-00028 and DPT-PDE-00029 specify that the FHA, FSSA and CCR shall be updated or confirmed at least once every five years.	C
11.3.1*	The fire protection assessments shall cover all locations within the protected area and areas external to the protected area that are under the scope of this Standard.	The Bruce A FHA NK21-REP-71400-00003, FSSA NK21-REP-71400-00004 and CCR NK21-REP-71400-00005 comprising the Fire Protection Assessment cover all locations within the protected area and non-nuclear areas. The buildings covered include: • Reactor Building • Turbine Generator • Pump Houses • Vacuum Building • Service Building • Fuel Oil Tanks • Standby Generators • Fuel Oil Pumphouse • (Old) Water Treatment Plant Building	C

Article No.	Clause Requirement	Assessment	Compliance Category
		• Ancillary Services Building • East Service Bay • Amenities Building • HPECI Grade Level Storage Tank (TK6) • Accumulator Building • EFADS/PARMS Building • Main Security Building • Station Access Tunnel • Retube Building • (New) Water Treatment Plant Building • Main and Service Transformer Area	
11.3.2*	The fire protection assessments shall cover fires occurring during all operational modes, including power operation, shutdown or start-up, and outages.	The FSSA (NK21-REP-71400-00004) addresses all plant operational modes	C
11.4*	The defence-in-depth principle specified in Clause 5.3 requires that multiple, independent fire protection measures be used to achieve a high degree of assurance that nuclear safety will be maintained at all times. The defence-in-depth principle shall be used in the fire protection assessments to help determine the fire protection measures needed to ensure the achievement of the nuclear safety objectives specified in Clause 5.4.1.	The FSSA (NK21-REP-71400-00004) includes a defense-in-depth review involving an assessment of fire hazards and postulated scenarios and the impact on FSSA-credited components, including assessment of the detection and suppression systems provided.	C
11.5	Assumptions used and not specified in Clause 11.5, Items (a) to (f), shall be clearly stated and justified in the documentation. When assessing fire hazards and consequences of fires, the following are considered acceptable assumptions: (a) Fires need not be postulated coincident with independent, low-frequency events or accidents in the plant. (b) Two or more simultaneous, independent fires in a	The only component of the Fire Protection Assessment that entails calculational methodology is the FSSA (NK21-REP-71400-00004). The FSSA lists all assumptions which were utilized in preparing fire scenarios and analyzing fire safe shutdown impacts in a section "FSSA Assumptions/Initial (Pre-fire) Plant Conditions", which contains all the assumptions in this clause..	C

Article No.	Clause Requirement	Assessment	Compliance Category
	plant or adjacent plant units need not be postulated. (c) In a fire safe shutdown analysis, failure of a single component need not be postulated coincident with failures caused by fire. (d) Credit may be given to equipment or components that result in fail-safe conditions after damage by fire or fire suppression action (e.g., loss of power to shut-off rods resulting in reactor trip), provided that the fail-safe characteristics of the equipment or component are individually assessed against the failure modes induced by the fire or fire suppression action. (e) Manual action by operators may be credited toward the accomplishment of the nuclear safety objectives (provided that the necessary conditions for correct and timely actions have been identified and justified). (f) Credit may be given for repair or replacement of components or circuits that are damaged or disabled by fire, provided that the following conditions are met: (i) Such credits are kept to a minimum. (ii) Credit is given only for restoring long-term functions after the reactor has been shutdown, cooled, and depressurized. (iii) It is demonstrated that all necessary work can be completed before the component or circuit is required to act. (iv) Procedures and training are provided for the repair or replacement work. (v) Necessary components, cables, and parts are available on site.		
11.6	Limitations and uncertainties concerning the data and methods used shall be identified. The assessment and analysis shall demonstrate that these limitations and	The only component of the Fire Protection Assessment that entails calculational methodology is the FSSA (NK21-REP-71400-00004). The FSSA documents	C

Article No.	Clause Requirement	Assessment	Compliance Category
	uncertainties are adequately addressed (e.g., by the use of suitable safety margins). Note: Appropriate sensitivity analysis may be necessary to demonstrate suitable safety margins in light of uncertainties in data and methods.	uncertainty in the fire modeling utilized and safety margins used to address limitations and uncertainties, such as those in the fire modeling calculations and fire scenario development.	
11.7*	The following documentation is required as a minimum: (a) the SSCs required to perform the nuclear safety objectives defined in Clause 5.4 and their location; (b) the general usage of the fire compartment or zone, including the major equipment present; (c) the inventory and configuration of combustible materials in each fire zone; (d) postulation of the design basis fires in each fire zone and assessment of resulting damage to plant SSCs; (e) postulation of the failures, and potential failure modes, of equipment in applicable fire zone and assessment of resulting impacts to plant fire safe shutdown; (f) the technical basis of each step in demonstrating the achievement of safety objectives of the standard; (g) fire mitigation measures, including: (i) fire detection; (ii) automatic and manual suppression; (iii) fire separations; (iv) spatial separations; and (v) smoke control; (h) verification that the nuclear safety performance criteria specified in Clause 5.4.2 have been met, or additional fire protection measures that are required; (i) verification that the criteria for the protection of radioactive materials outside the reactor, as defined in Clause 5.4.3, have been met, or additional fire protection	(a) The FHA (NK21-REP-71400-00003) and FSSA (NK21-REP-71400-00004) identify all credited safe shutdown components, potential fixed fire sources and their impact on safe shutdown, and fire protection features credited for supporting safe shutdown capability. (b) The “Fire Zone Description” field of the datasheets in the FHA Report provides the general usage of the fire zone and description of the zone, including major plant equipment. (c)The FHA datasheet field “Types and Quantities of Combustibles” identifies the in situ combustibles. The “Laydown/Storage Areas” and field of the datasheets in the FHA notes the presence of Extended Storage Areas and Transient Material Permit Storage Areas, and Radioactive Material Storage Areas and the “Transient Hazards” field identify the impacts of potential transient fires on fire safe shutdown and life safety. (d),(e),(f) The impact of all postulated fire scenarios, including fixed ignition sources, potential transient combustibles, and storage/laydown areas has been assessed individually for each fire zone in the FHA. The results of the target impacts from potential fires are addressed in the FSSA (g) The FSSA documents the detection and suppression measures credited for specific fire	C

Article No.	Clause Requirement	Assessment	Compliance Category
	measures that are required; (j) compliance with the applicable requirements of this Standard and referenced documents; and (k) assessment of effectiveness, appropriateness, and reliability of the fire protection measures in meeting the goals and objectives of this Standard.	scenarios, including manual fire fighting capability; as well as smoke control measures, fire rated barriers, “performance” barriers, and “spatial” barriers credited as fire mitigation measures.. (h) The Room Summary Sheets in the FSSA provide an assessment of the capability to achieve the nuclear safety performance criteria specified in Clause 5.4.2 based on the postulated fire scenarios. (i) The “Radiological Hazard Potential” field of the datasheets in the FHA addresses the potential for radiological release due to fire including the potential for contaminated spread of smoke or suppression water. Where potential of radiological impact is identified, recommendations are included in the "Recommendations to Improve Fire Protection Capability" field. (j), (k) The CCR (NK21-REP-71400-00005) documents compliance with the operational requirements of CSA N293 and applicable construction codes. The intent is to document the adequacy of the installed fire protection features in meetings the goals and objectives of CSA N293.	
11.8.1	The preparation and review of the fire protection assessments required by this Standard shall comply with the quality assurance requirements of CSA N286. The CSA N286 requirements shall also apply to any revisions.	The Bruce Power procedures (DPT-PDE-00027, DPT-PDE-00028, DPT-PDE-00029) governing preparation, review and update of the components of a Fire Protection Assessment all require adherence to applicable clauses of CSA N286-05. Preparation or revision of a component of a Fire Protection Assessment is conducted as per an Analysis Plan demonstrating adherence to the quality assurance requirements of CSA N286-05.	C

Article No.	Clause Requirement	Assessment	Compliance Category
11.8.2	Fire protection assessments performed to demonstrate compliance to this Standard shall be auditable.	The Bruce Power procedures (DPT-PDE-00027, DPT-PDE-00028, DPT-PDE-00029) governing preparation, review and update of the components of a Fire Protection Assessment all require that all elements of the assessments be treated as Controlled Documents stored in PassPort.	C
11.8.3*	The fire protection assessments shall be prepared by personnel with knowledge of fire protection, plant design, and nuclear safety. This qualification of personnel applies to the preparation of the original document and to periodic updating of the assessment.	Preparation or revision of a component of a Fire Protection Assessment is conducted as per an Analysis Plan which includes the qualifications of personnel carrying out the work.	C

*An asterisk beside a clause number identifies those clauses for which further information is provided in Annex A (informative)

Appendix C – Code-to-Code Comparison for Updated Codes and Standards

C.1. Comparison of CSA N293-12 Fire Protection for CANDU Nuclear Power Plants to CSA N293-07, Fire Protection for CANDU Nuclear Power Plants

In support of the review tasks listed in Section 5, a code-to-code comparison has been performed for CSA N293-12 to the previous version assessed (CSA N293-07). CSA N293-12 clauses without equivalent clauses in CSA N293-07 have been identified in Table C1. An incremental clause-by-clause assessment of these new requirements has been performed in Appendix B.3, within Table B3.

Table C1: Code-to-Code Comparison of CSA N293-12, Fire Protection for CANDU Nuclear Power Plants, Against CSA N293-07, Fire Protection for CANDU Nuclear Power Plants

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
4		CSA N293-07 : Clause 4		Equivalent
4.1	This Standard shall come into force on the date specified by the plant license.	CSA N293-07 : Clause 4.1 This Standard shall come into force on the date specified by the plant licence.		Equivalent
4.2	Unless otherwise specified, the licensee of a plant is responsible for meeting the requirements of this Standard. The licensee may delegate a task required by this Standard, but retains overall responsibility for fulfilling its requirements.	CSA N293-07 : Clause 4.2 Unless otherwise specified, the licensee of a plant is responsible for meeting the requirements of this Standard. The licensee may delegate a task required by this Standard, but retains overall responsibility for fulfilling its requirements.		Equivalent
4.3*		CSA N293-07 : Clause 4.3		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
4.3.1*	This Standard applies to all plants where its requirements are referenced as a license condition by the AHJ. For facilities licensed for construction prior to the publication of this Standard, (a) the design and construction requirements of this Standard shall not be retroactively applied to existing structures, systems, and components; and (b) the operational requirements (e.g., general requirements, concepts, programs, operations, analyses, emergency response) of this Standard shall apply.	CSA N293-07 : Clause 4.3.1* This Standard applies to all plants where its requirements are referenced as a licence condition by the AHJ. For facilities licensed for construction prior to the publication of this Standard, (a) the design and construction requirements of this Standard shall not be retroactively applied to existing structures, systems, and components; and (b) the operational requirements (e.g., general requirements, concepts, programs, operations, analyses, emergency response) of this Standard shall apply.		Equivalent
4.3.2*	Modifications to the plant shall comply with the requirements of this Standard. Where the design or construction of an existing plant precludes compliance with the requirements of this Standard, concurrence from the AHJ shall be obtained for any deviation. The requirements of Clauses 4.4 and 4.5 shall be met under all circumstances.	CSA N293-07 : Clause 4.3.2* Modifications to the plant shall comply with the requirements of this Standard. Where the design or construction of an existing plant precludes compliance with the requirements of this Standard, concurrence from the AHJ shall be obtained for any deviation. The requirements of Clauses 4.6 and 4.7 shall be met under all circumstances.		Equivalent
4.4		CSA N293-07 : Clause 4.4		Equivalent
4.4.1	This Standard is in no way intended to preclude the use of alternative materials, means, measures, procedures, processes, approaches, or technologies where the alternative is demonstrated, with appropriate supporting documentation, to meet the intent of this Standard. Where alternatives are used, the requirements of Clauses 4.4 and 4.5 shall be met.	CSA N293-07 : Clause 4.4.1 This Standard is in no way intended to preclude the use of alternative materials, means, measures, procedures, processes, approaches, or technologies where the alternative is demonstrated, with appropriate supporting documentation, to meet the intent of this Standard, and where the AHJ concurs with the alternative approach. Where alternatives are used, the requirements of Clauses 4.6 and 4.7 shall be met.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
4.4.2	The requirements of this Standard may be met through the implementation of performance-based design or operational approaches that are in accordance with the intent of this Standard, and where the AHJ concurs with the performance-based approach. Where performance-based approaches are used, the requirements of Clauses 4.5 shall be met.	CSA N293-07 : Clause 4.4.2 The requirements of this Standard may be met through the implementation of performance-based design or operational approaches that are in accordance with the intent of this Standard, and where the AHJ concurs with the performance-based approach. Where performance-based approaches are used, the requirements of Clauses 4.6 and 4.7 shall be met.		Equivalent
4.4.3	Alternatives or performance-based design approaches shall be submitted to, and concurrence shall be obtained from, the AHJ prior to implementation.	CSA N293-07 : Clause 4.6.1 Alternatives or performance-based design approaches shall be submitted to, and concurrence shall be obtained from, the AHJ prior to implementation, in accordance with Clause 4.5.		Equivalent
4.5		CSA N293-07 : Clause 4.7*		Equivalent
4.5.1	Where alternatives or performance-based design or operational approaches are used, they shall be adequately supported by procedures, references, and documentation for review by the AHJ and a qualified third party.	CSA N293-07 : Clause 4.7.1 Where alternatives or performance-based design or operational approaches are used, they shall be adequately supported by procedures, references, and documentation in accordance with the review by the AHJ and a qualified third party.		Equivalent
4.5.2	Where alternatives or performance-based design or operational approaches are implemented, details of any deviation from the requirements and procedures stated in this Standard shall be documented in the code compliance review and considered in the fire hazard assessment.	CSA N293-07 : Clause 4.7.2 Where alternatives or performance-based approaches are implemented, details of any deviation from the requirements and procedures stated in this Standard shall be documented in the code compliance review and considered in the fire hazard assessment.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
4.5.3	The documentation shall be appropriate for the complexity of the deviation and the potential safety hazard. As a minimum, documentation shall include (a) the goals, objectives, and safety functions of the requirement for which alternatives are sought; (b) the reasons why the requirement cannot be met (e.g., high cost, impracticality, better alternative available, conflict with other safety requirements); (c) a description of the proposed alternative including, as appropriate, a design description, drawings, specifications, etc.; (d) the reasons why the alternative will achieve the intended safety functions, including assumptions, technical references, calculations, test reports, etc.; (e) the inspection, testing, and maintenance requirements of the proposed design to ensure continued performance; (f) operational requirements, such as operating procedures and training; and (g) the decommissioning requirements of the design.	CSA N293-07 : Clause 4.7.3 The documentation shall be appropriate for the complexity of the deviation and the potential safety hazard. As a minimum, documentation shall include (a) the goals, objectives, and safety functions of the requirement for which alternatives are sought; (b) the reasons why the requirement cannot be met (e.g., high cost, impracticality, better alternative available, conflict with other safety requirements); (c) a description of the proposed alternative including, as appropriate, a design description, drawings, specifications, etc.; (d) the reasons why the alternative will achieve the intended safety functions, including assumptions, technical references, calculations, test reports, etc.; (e) the inspection, testing, and maintenance requirements of the proposed design to ensure continued performance; (f) operational requirements, such as operating procedures and training; and (g) the decommissioning requirements of the design.		Equivalent
4.6		CSA N293-07 : Clause 4.5	CSA N293-07 requires conduct of a Code Compliance Review (CCR), Fire Hazards Assessment (FHA) and Fire Safety Shutdown Analysis), while N293-12 requires conduct of a fire protection assessment. At Bruce Power, a Fire Protection Assessment or Fire Safety Assessment is defined as being comprised of the three components CCR, FHA and FSSA (see DPT-PDE-00027). So the two clauses are identical in intent (see Note after clause 4.6.2).	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
4.6.1	To ensure an adequate level of fire protection, each plant shall conduct fire protection assessments demonstrating compliance with the applicable requirements of this standard. Documents forming part of the fire protection assessments shall be submitted to the AHJ for acceptance.	CSA N293-07 : Clause 4.5.1 To demonstrate an adequate level of safety, each plant shall undergo a CCR, FHA, and FSSA. Where there are no deviations, the CCR shall declare the facility as being in compliance with this Standard. The results of the CCR, FHA, and FSSA shall be documented and submitted to the AHJ for acceptance.	CSA N293-07 requires conduct of a Code Compliance Review (CCR), Fire Hazards Assessment (FHA) and Fire Safety Shutdown Analysis), while N293-12 requires conduct of a fire protection assessment. At Bruce Power, a Fire Protection Assessment or Fire Safety Assessment is defined as being comprised of the three components CCR, FHA and FSSA (see DPT-PDE-00027). So the two clauses are identical in intent.(see Note after clause 4.6.2).	Equivalent
4.6.2	For facilities licensed for operation prior to the publication of this Standard, the assessments referred to in Clause 4.6.1 shall demonstrate achieving (a) the goals, objectives and criteria of Clause 5; (b) the operational requirements of this standard; and (c) the applicable design and construction requirements of the codes of record. Note: It is intended by this Standard that fire protection assessments required by this Clause can be satisfied by previous analysis performed in accordance with the 2007 edition of this Standard (i.e., CCR, FHA, FSSA, etc.) and maintained in compliance with Clause 11.2.3.	CSA N293-07 : Clause 4.5.2 For facilities licensed for operation prior to the publication of this Standard, a CCR shall be performed against the operational requirements of this Standard and applicable construction codes. The FHA and FSSA shall comply with the requirements of this Standard.	CSA N293-07 Cl 4.5.2 discusses compliance of CCR, FHA & FSSA, while N293-12 Cl 4.6.2 discusses "the assessments referred to in Clause 4.6.1", ie an FPA consisting of a CCR, FHA & FSSA. These are equivalent.	Equivalent
4.6.3	When included as part of the plant's license, the facility shall comply with the requirements of this Standard.	CSA N293-07 : Clause 4.5.3 When included as part of the plant's construction license, the facility shall (a) be designed in accordance and comply with the requirements of this Standard; and (b) include the development of a CCR, FHA, and FSSA.		Equivalent
5		CSA N293-07 : Clause 5		Equivalent
5.1		CSA N293-07 : Clause 5.1		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.1.1	Clause 5 specifies the general fire protection concepts and performance levels applicable to the life cycle of a plant.	CSA N293-07 : Clause 5.1.1 Clause 5 specifies the general fire protection concepts and performance levels applicable to the life cycle of a plant.		Equivalent
5.1.2*	Clauses 6 to 11 state the requirements for achieving the fire protection levels specified in Clause 5.	CSA N293-07 : Clause 5.1.2* Clauses 6 to 11 state the requirements for achieving the fire protection levels specified in Clause 5.		Equivalent
5.1.3	Where specific design or operational requirements are not addressed in this Standard, the NBCC, or the NFCC, good engineering practice shall apply and, where appropriate, recognized Standards (such as those of the National Fire Protection Association [NFPA]) shall be used.	CSA N293-07 : Clause 5.1.3 Where specific design or operational requirements are not addressed in this Standard, the NBCC, or the NFCC, good engineering practice shall apply and, where appropriate, recognized Standards (such as those of the National Fire Protection Association [NFPA]) shall be used.		Equivalent
5.1.4	The facility shall be designed, operated, inspected, tested, and maintained so that the goals, objectives, and criteria of Clause 5 are achieved for all postulated fire scenarios and failure modes within the scope of this Standard.	CSA N293-07 : Clause 5.1.4 The facility shall be designed, operated, inspected, tested, and maintained so that the safety performance goals, objectives, and criteria of Clause 5 are achieved for all postulated fire scenarios and failure modes within the scope of this Standard.		Equivalent
5.2*	The fire protection goals for plants are (a) to minimize the risk of radiological releases to the public that are a result of fire; (b) to protect plant occupants from death or injury due to fire; (c) to minimize economic loss resulting from fire damage to structures, equipment, and inventories; and (d) to minimize the impact of radioactive and hazardous materials on the environment as a result of fire.	CSA N293-07 : Clause 5.2* The fire protection goals for plants are (a) to minimize the risk of radiological releases to the public that are a result of fire; (b) to protect plant occupants from death or injury due to fire; and (c) to minimize economic loss resulting from fire damage to structures, equipment, and inventories.	Requirement (d) is new: "(d) to minimize the impact of radioactive and hazardous materials on the environment as a result of fire."	Different
5.3*		CSA N293-07 : Clause 5.3*		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.3.1*	The defence-in-depth principle shall be used to achieve a high degree of fire protection by providing redundancy, diversity, and balance in fire protection measures. The elements of the defence-in-depth principle are outlined in Clauses 5.3.2 to 5.3.4.	CSA N293-07 : Clause 5.3.1* The defence-in-depth principle shall be used to achieve a high degree of fire protection by providing redundancy, diversity, and balance in fire protection measures. The elements of the defence-in-depth principle are outlined in Clauses 5.3.2 to 5.3.4.		Equivalent
5.3.2	Design measures shall be put in place to reduce or eliminate, where practicable, combustible materials, and ignition sources, and a fire protection program shall be implemented in all operational modes in order to reduce the occurrence of fires and limit their consequences and severity.	CSA N293-07 : Clause 5.3.2 Design measures shall be put in place to reduce or eliminate, where practicable, materials, oxidizers, and ignition sources, and a fire protection program shall be implemented in all operational modes in order to reduce the occurrence of fires and limit their consequences and severity.		Equivalent
5.3.3	Means shall be provided to quickly detect and extinguish or control fires.	CSA N293-07 : Clause 5.3.3 Means shall be provided to quickly detect and extinguish or control fires.		Equivalent
5.3.4*	Fire separations or other measures shall be provided to limit the spread of fire and its effects, thus minimizing the impact on the plant and its occupants.	CSA N293-07 : Clause 5.3.4* :Fire separations or other measures shall be provided to limit the spread of fire and its effects, thus ::minimizing the impact on the plant and its occupants.		Equivalent
5.4		CSA N293-07 : Clause 5.4		Equivalent
5.4.1		CSA N293-07 : Clause 5.4.1		Equivalent
5.4.1.1*	In the event of a fire, the plant shall be capable of (a) achieving and maintaining the reactor in subcritical conditions; (b) achieving and maintaining decay heat removal; (c) maintaining the integrity of the fission product boundaries; and (d) limiting the release of radioactive materials that are located outside the reactor.	CSA N293-07 : Clause 5.4.1.1* In the event of a fire, the plant shall be capable of (a) achieving and maintaining the reactor in subcritical conditions; (b) achieving and maintaining decay heat removal; (c) maintaining the integrity of the fission product boundaries; and (d) limiting the release of radioactive materials that are located outside the reactor.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.4.1.2	The safety objectives of Clause 5.4.1.1 shall be maintained for all plant operational modes, including full or partial power operation, start-up, shutdown, and any outages.	CSA N293-07 : Clause 5.4.1.2 The safety objectives of Clause 5.4.1.1 shall be maintained for all plant operational modes, including full or partial power operation, start-up, shutdown, and any outages.		Equivalent
5.4.2		CSA N293-07 : Clause 5.4.2		Equivalent
5.4.2.1	To achieve the objectives of Clause 5.4.1.1(a) to (c), the requirements of Clauses 5.4.2.2 to 5.4.2.6 shall be met.	CSA N293-07 : Clause 5.4.2.1 To achieve the objectives of Clause 5.4.1.1, the requirements of Clauses 5.4.2.2 to 5.4.2.6 shall be met.	In N293-07, the objectives of all Clause 5.4.1.1 elements, including element (d), were cited; in N293-12, element (d) is excluded: "(d) limiting the release of radioactive materials that are located outside the reactor." Instead, achievement of element (d) is moved into added requirement 5.4.3.1	Equivalent
5.4.2.2*	Means shall be provided to rapidly insert negative reactivity into the reactor core in order to achieve and maintain subcritical conditions and ensure fuel design limits are not exceeded.	CSA N293-07 : Clause 5.4.2.2* Means shall be provided to rapidly insert negative reactivity into the reactor core in order to achieve and maintain subcritical conditions and ensure fuel design limits are not exceeded.		Equivalent
5.4.2.3*	Means shall be provided to ensure that fuel is in a safe and stable condition, through the maintenance of sufficient coolant levels and the removal of decay heat from the reactor.	CSA N293-07 : Clause 5.4.2.3* Means shall be provided to ensure that fuel is in a safe and stable condition, through the maintenance of sufficient coolant levels and the removal of decay heat from the reactor.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.4.2.4*	Means shall be provided to ensure that nuclear reactor systems that contain radioactive materials or fission products, including the reactor coolant system and reactor auxiliary systems, shall not be breached. There shall be no leakage of coolant beyond the capability of the pressure and inventory make-up system. In addition, the containment system's integrity shall not be breached.	CSA N293-07 : Clause 5.4.2.4* Means shall be provided to ensure that nuclear reactor systems that contain radioactive materials or fission products, including the primary heat transport system, moderator system, and reactor auxiliary systems, shall not be breached. There shall be no leakage of coolant beyond the capability of the pressure and inventory make-up system. In addition, the containment system's integrity shall not be breached.		Equivalent
5.4.2.5	Means for supplying the necessary power, water, compressed air, and other support functions shall be provided to ensure that the criteria of Clauses 5.4.2.2 to 5.4.2.4 and Clause 5.4.2.6 are met.	CSA N293-07 : Clause 5.4.2.5 Means for supplying the necessary power, water, compressed air, and other support functions shall be provided to ensure that the criteria of Clauses 5.4.2.2 to 5.4.2.4 and 5.4.2.6 are met.		Equivalent
5.4.2.6*	Plant monitoring means shall be provided so that operators are able to perform actions to ensure that the criteria of Clauses 5.4.2.2 to 5.4.2.5 are achieved and maintained. Sufficient instrumentation shall remain available to assess the plant status as defined in CSA N290.6.	CSA N293-07 : Clause 5.4.2.6* Plant monitoring means shall be provided so that operators are able to perform actions to ensure that the criteria of Clauses 5.4.2.2 to 5.4.2.5 are achieved and maintained. Sufficient instrumentation shall remain available to assess the plant status as defined in CSA CAN3-N290.6.		Equivalent
5.4.3		CSA N293-07 : Clause 5.4.3	N293-07 Clause title omitted the part "Nuclear Safety Performance Criteria". However, the intent is clearly the same for both clauses.	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.4.3.1	To achieve the objective of Clause 5.4.1.1(d), the requirements of Clauses 5.4.3.2 to 5.4.3.4 shall be met.	CSA N293-07 : Clause 5.4.2.1 To achieve the objectives of Clause 5.4.1.1, the requirements of Clauses 5.4.2.2 to 5.4.2.6 shall be met	In N293-07, the objectives of all Clause 5.4.1.1 elements, including element (d), were cited; in N293-12, element (d) is excluded: "(d) limiting the release of radioactive materials that are located outside the reactor." Instead, achievement of element (d) is moved into added requirement 5.4.3.1	Equivalent
5.4.3.2*	Radioactive and fissionable materials (including spent and new fuel, and radioactive wastes) shall be protected from the effects of fire using appropriate design measures and storage arrangements, including those that minimize exposure to combustible materials.	CSA N293-07 : Clause 5.4.3.1* Radioactive and fissionable materials (including spent and new fuel, and radioactive wastes) shall be protected from the effects of fire using appropriate design measures and storage arrangements, including those that minimize exposure to combustible materials.		Equivalent
5.4.3.3	The release of radioactive materials as a result of a fire or fire suppression activities shall be as low as is reasonably achievable.	CSA N293-07 : Clause 5.4.3.2 The release of radioactive materials as a result of a fire or fire suppression activities shall be as low as is reasonably achievable.		Equivalent
5.4.3.4	Fissionable material shall be protected from becoming critical due to fire or fire suppression activities.	CSA N293-07 : Clause 5.4.3.3 Fissionable material shall be protected from becoming critical due to fire or fire suppression activities.		Equivalent
5.5		CSA N293-07 : Clause 5.5		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.5.1	The following life safety performance objectives shall be met during all operational modes and plant configurations: (a) Fire hazard controls shall be included in design and operational stages. (b) Fire notification means shall be provided. (c) Safe egress and/or areas of refuge shall be provided for occupants for use in the event of a fire. (d) A safe environment and other required supports shall be provided for essential staff so that they can perform all necessary plant control functions during and following a fire. (e) Protection for personnel performing emergency services shall be provided both during and following a fire. (f) Access and emergency lighting shall be provided for all areas where manual firefighting, evacuations, or operator field actions are expected.	CSA N293-07 : Clause 5.5.1 The following life safety performance objectives shall be met during all operational modes and plant configurations: (a) Fire hazard controls shall be included in design and operational stages. (b) Fire notification means shall be provided. (c) Safe egress and/or areas of refuge shall be provided for occupants for use in the event of a fire. (d) A safe environment and other required supports shall be provided for essential staff so that they can perform all necessary plant control functions during and following a fire. (e) Protection for personnel performing emergency services shall be provided both during and following a fire. (f) Access and emergency lighting shall be provided for all areas where manual firefighting, evacuations, or operator field actions are expected.		Equivalent
5.5.2		CSA N293-07 : Clause 5.5.2		Equivalent
5.5.2.1	The life safety objectives of Clause 5.5.1 shall be met using either the prescriptive requirements or performance-based criteria outlined in the NBCC and NFCC. Note: Compliance with the prescriptive requirements of the NBCC and NFCC might not be adequate to meet the requirements of Clause 5.5.1 in all cases.	CSA N293-07 : Clause 5.5.2.1 The life safety objectives of Clause 5.5.1 shall be met using either the prescriptive requirements or performance-based criteria outlined in the NBCC and NFCC. Note: Compliance with the prescriptive requirements of the NBCC and NFCC might not be adequate to meet the requirements of Clause 5.5.1 in all cases		Equivalent
5.5.2.2*	Except as otherwise indicated in this Standard, plants shall be designed, modified, and constructed in accordance with all applicable requirements of the NBCC.	CSA N293-07 : Clause 5.5.2.2* Except as otherwise indicated in this Standard, plants shall be designed, modified, and constructed in accordance with all applicable requirements of the NBCC.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.5.2.3*	Except as otherwise indicated in this Standard, plants shall comply with all applicable requirements of the NFCC.	CSA N293-07 : Clause 5.5.2.3* Except as otherwise indicated in this Standard, plants shall comply with all applicable requirements of the NFCC.		Equivalent
5.6		CSA N293-07 : Clause 5.6 Note: See Annex B for guidelines for the preparation of a fire safe shutdown analysis (FSSA).	N293-12 clause 5.6 and its sub-clauses have requirements not covered in N293-07 clause 5.6, as the scope is now Fire Protection Assessments, which cover the FSSAs covered in N293-07 clause 5.6, plus Code Compliance Reviews (CCRs) and Fire Hazard Assessments (FHAs)	Different
5.6.1	The fire protection assessments shall be prepared for every plant in accordance with the requirements in Clause 11 and shall include at least the following: (a) code compliance review; (b) fire hazard assessment; and (c) fire safe shutdown analysis.	CSA N293-07 : Clause 5.6.1 Compliance with the nuclear safety criteria of Clause 5.4 is demonstrated using an FSSA.	N293-12 clause 5.6 and its sub-clauses have requirements not covered in N293-07 clause 5.6, as the scope is now Fire Protection Assessments, which cover the FSSAs covered in N293-07 clause 5.6, plus Code Compliance Reviews (CCRs) and Fire Hazard Assessments (FHAs)	Different
5.6.2	The fire protection assessments shall be updated as necessary to reflect plant modifications, significant changes in fire hazards, and operating experience.	CSA N293-07 : Clause 5.6.4 The FSSA shall be updated as necessary to reflect plant modifications, significant changes in fire hazards, and operating experience.	N293-12 clause 5.6 and its sub-clauses have requirements not covered in N293-07 clause 5.6, as the scope is now Fire Protection Assessments, which cover the FSSAs covered in N293-07 clause 5.6, plus Code Compliance Reviews (CCRs) and Fire Hazard Assessments (FHAs)	Different
5.7		CSA N293-07 : Clause 5.7		Equivalent
5.7.1		CSA N293-07 : Clause 5.7.1		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.7.1.1	Buildings, both in the protected area or external to the protected area but directly supporting the plant, shall be constructed using non-combustible construction, as defined in the NBCC.	CSA N293-07 : Clause 5.7.1.1* Buildings, both in the protected area or external to the protected area but directly supporting the plant, shall be constructed using non-combustible materials, as defined in the NBCC.		Equivalent
5.7.1.2	The use of building fixtures and interior finishes made of combustible materials shall be minimized in buildings in the protected area or external to the protected area but directly supporting the plant.	CSA N293-07 : Clause 5.7.1.2 The use of building fixtures and interior finishes made of combustible materials shall be minimized in buildings in the protected area or external to the protected area but directly supporting the plant.		Equivalent
5.7.1.3	The use of transient combustible materials shall be minimized and controlled so they do not pose a fire hazard beyond the capabilities of existing fire protection measures. Where a fire hazard exceeds these capabilities, temporary or permanent fire protection measures that are commensurate with the fire hazard shall be provided.	CSA N293-07 : Clause 5.7.1.3 The use of transient combustible materials shall be minimized and controlled so they do not pose a fire hazard beyond the capabilities of existing fire protection measures. Where a fire hazard exceeds these capabilities, temporary or permanent fire protection measures that are commensurate with the fire hazard shall be provided.		Equivalent
5.7.1.4	Plant design shall ensure that combustible materials, dangerous goods, and liquids and gases used for plant operations are stored, located, and protected to minimize fire hazards and the resultant threats to nuclear and life safety.	CSA N293-07 : Clause 5.7.1.4 Plant design shall ensure that combustible materials, dangerous goods, and liquids and gases used for plant operations are stored, located, and protected to minimize fire hazards and the resultant threats to nuclear and life safety.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.7.1.5*	Liquids with flash points greater than 93.3 °C (200°F) shall be treated as (a) Class IIIA liquids and protected in accordance with the NFCC; or (b) Class IIIB liquids and protected in accordance with NFPA 30. These liquids shall be considered in the FPA.	CSA N293-07 : Clause 5.7.1.5* Combustible liquids with flash points greater than 93.3 °C (200°F) shall be treated as Class IIIA liquids and protected in accordance with the NFCC as well as considered in the FSSA.	N293-07 required that liquids with high flash points be treated as Class IIIA liquids; N293-12 allows them to be treated as either Class IIIA or Class IIIB liquids and protected via a different standard. N293-12 requirement is less restrictive, so compliance with N293-07 Clause 5.7.1.5 will automatically translate into compliance with N293-12 Clause 5.7.1.5. For the purposes of this assessment, since no further work is needed, the codes are treated as equivalent.	Equivalent
5.7.2		CSA N293-07 : Clause 5.7.2		Equivalent
5.7.2.1	Installed devices and process operations that, by design, pose a fire hazard shall be identified and analyzed or addressed in the design stage of the plant and shall be eliminated or controlled in order to minimize the occurrence of fires.	CSA N293-07 : Clause 5.7.2.1 Installed devices and process operations that, by design, pose a fire hazard shall be identified and analyzed or addressed in the design stage of the plant and shall be eliminated or controlled in order to minimize the occurrence of fires.		Equivalent
5.7.2.2	Temporary ignition sources (e.g., hot work activities, use of heat producing devices) that support work shall be located or controlled in accordance with the NFCC to ensure that ignition sources do not come into contact with combustible materials or flammable liquids or vapours.	CSA N293-07 : Clause 5.7.2.2 Temporary ignition sources (e.g., hot work activities, use of heat producing devices) that support work shall be located or controlled in accordance with the NFCC to ensure that ignition sources do not come into contact with combustible materials or flammable liquids or vapours.		Equivalent
5.7.2.3	Electrical equipment and wiring shall be installed in accordance with the Canadian Electrical Code, Part I.	CSA N293-07 : Clause 5.7.2.3 Electrical equipment and wiring shall be installed in accordance with the Canadian Electrical Code, Part I.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.7.2.4*	Buildings and equipment shall be protected from lightning.	CSA N293-07 : Clause 5.7.2.4* Buildings and equipment shall be protected from lightning.		Equivalent
5.7.2.5*	The potential for fires external to the plant shall be identified, assessed, and mitigated in accordance with the nuclear and life safety criteria of Clauses 5.4 and 5.5.	CSA N293-07 : Clause 5.7.2.5* The potential for fires external to the plant shall be identified, assessed, and mitigated in accordance with the nuclear and life safety criteria of Clauses 5.4 and 5.5.		Equivalent
5.7.2.6*	Explosion hazards shall be eliminated by design, where possible. Where explosion hazards cannot be eliminated, their impact shall be assessed and features shall be provided to ensure that the nuclear and life safety criteria of Clauses 5.4 and 5.5 are met.	CSA N293-07 : Clause 5.7.2.6 Explosion hazards shall be eliminated by design, where possible. Where explosion hazards cannot be eliminated, their impact shall be assessed and features shall be provided to ensure that the nuclear and life safety criteria of Clauses 5.4 and 5.5 are met.		Equivalent
5.7.3		CSA N293-07 : Clause 5.7.3		Equivalent
5.7.3.1*	A fire alarm system shall be provided in buildings.	CSA N293-07 : Clause 5.7.3.1* A fire alarm system shall be installed in buildings. The types of fire alarm systems, their performance levels, and associated safety features shall be in accordance with this Standard and the NBCC		Equivalent
5.7.3.2*	The types of fire alarm systems, their performance levels, and associated safety features shall be as a minimum in accordance with (a) this Standard; (b) the NBCC; (c) the NFCC, (d) the FPA; and (e) good engineering practices.	CSA N293-07 : Clause 5.7.3.2* Fire alarm systems shall, at a minimum, be in accordance with (a) this Standard; (b) the NBCC; (c) the NFCC, (d) the FSSA; and (e) good engineering practices.	N293-07 cited the use of FSSA to demonstrate fire protection goals, while N293-12 cites use of FPA (ie CCR and/or FHA and/or FSSA).	Equivalent
5.7.4		CSA N293-07 : Clause 5.7.4		Equivalent
5.7.4.1		CSA N293-07 : Clause 5.7.4.1		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.7.4.1.1*	A fire response program, together with other fire protection measures, shall be capable of meeting the fire protection goals outlined in Clause 5.2. This capability shall cover the entire life cycle of the plant, with the exception of the design stage, and shall be achieved in accordance with Clause 10.	CSA N293-07 : Clause 5.7.4.1.1 A fire response program, together with other fire protection measures, shall be capable of meeting the fire protection goals outlined in Clause 5.2. This capability shall cover the entire life cycle of the plant, with the exception of the design stage, and shall be achieved in accordance with Clause 10.		Equivalent
5.7.4.1.2*	Industrial fire brigade members who are responsible for responding to the most resource-demanding fires shall have no plant duties that would prevent an immediate response to these or other fires.	CSA N293-07 : Clause 5.7.4.1.2* Industrial fire brigade members who are responsible for responding to the most resource-demanding fires shall have no plant duties that would prevent an immediate response to these or other fires.		Equivalent
5.7.4.2		CSA N293-07 : Clause 5.7.4.2		Equivalent
5.7.4.2.1*	Automatic fire suppression systems shall be provided for buildings, structures, and equipment, except where it is demonstrated by the FPA or other assessments that fire protection goals can be met using other fire protection measures.	CSA N293-07 : Clause 5.7.4.2.1* Automatic fire suppression systems shall be provided for buildings, structures, and equipment, except where it is demonstrated by the FHA or other assessments that fire protection goals can be met using other fire protection measures.	N293-07 cited the use of FHA or other assessments to demonstrate fire protection goals, while N293-12 cites use of FPA (ie CCR and/or FHA and/or FSSA) or other assessments. These citations are equivalent in intent.	Equivalent
5.7.4.2.2	Where automatic suppression systems are provided, they shall be (a) designed and installed in accordance with Clause 7; and (b) inspected, tested, and maintained in accordance with Clause 8.3.	CSA N293-07 : Clause 5.7.4.2.2 Where automatic suppression systems are provided, they shall be (a) designed and installed in accordance with Clause 7; and (b) inspected, tested, and maintained in accordance with Clause 8.	N293-07 required inspection, testing and maintenance in accordance with Clause 8, while N293-12 requires accordance with Sub-clause 8.3; however, Sub-clause 8.3 is the only part of Clause 8 dealing with inspection, testing and maintenance, so the intent is identical.	Equivalent
5.7.5		CSA N293-07 : Clause 5.7.5		Equivalent
5.7.5.1		CSA N293-07 : Clause 5.7.5.1		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.7.5.1.1	The layout of SSCs shall be identified, coordinated, and applied in the early stages of plant design in order to minimize the impact of fire.	CSA N293-07 : Clause 5.7.5.1.1 The layout of equipment and structures shall be identified, coordinated, and applied in the early stages of plant design in order to minimize the impact of fire on nuclear and life safety and to prevent loss.	N293-07 referred to layout of equipment and structures, while N293-12 refers more generally to systems, structures or components. The intent is identical.	Equivalent
5.7.5.1.2	Fire separation between floors and areas within each building and between buildings shall be provided in accordance with the NBCC, NFCC, and Clause 6, except in the containment structures.	CSA N293-07 : Clause 5.7.5.1.2 Fire separation between floors and areas within each building and between buildings shall be provided in accordance with the NBCC, NFCC, and Clause 6, except in the containment structures.		Equivalent
5.7.5.1.3*	To maintain the nuclear safety objectives of Clause 5.4.1, the fire safe shutdown systems shall be divided into redundant groups, with adequate separation between groups in accordance with Clause 6.	CSA N293-07 : Clause 5.7.5.1.3* To maintain the nuclear safety objectives of Clause 5.4, the fire safe shutdown systems shall be divided into redundant groups, with adequate separation between groups in accordance with Clause 6.		Equivalent
5.7.5.1.4	Systems, components, and materials that pose a significant fire hazard shall be located so that the consequences of fire are minimized. Safety-related systems located near a fire hazard shall be provided with a fire separation or spatial separation that is appropriate for the assessed fire hazard, in accordance with the FPA.	CSA N293-07 : Clause 5.7.5.1.4 Systems, components, and materials that pose a significant fire hazard shall be located such that the consequences of fire are minimized. Safety-related systems located near a fire hazard shall be provided with a fire separation or spatial separation that is appropriate for the assessed fire hazard, in accordance with the FSSA.	N293-07 cited an FSSA, while N293-12 more generally cites the FPA (consisting of CCR, FHA & FSSA)	Equivalent
5.7.5.1.5	Cable trays shall be located and protected to reduce the potential for fire spread. Where manual fire suppression is required to meet the fire protection objectives, access to the cable area and adequate clearance between cable trays shall be provided.	CSA N293-07 : Clause 5.7.5.1.5 Cable trays shall be located and protected so as to reduce the potential for fire spread. Where manual fire suppression is required to meet the fire protection objectives, access to the cable area and adequate clearance between cable trays shall be provided.		Equivalent
5.7.5.2		CSA N293-07 : Clause 5.7.5.2		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.7.5.2.1	Where fire separations are used, the fire resistance rating shall be appropriate for the fire hazards present in a fire compartment and its adjoining fire compartments. Maintenance of these fire separations shall be in accordance with the NFCC and Clause 8 of this Standard.	CSA N293-07 : Clause 5.7.5.2.1 Where fire separations are used, the fire resistance rating shall be appropriate for the fire hazards present in a fire compartment and its adjoining fire compartments. Maintenance of these fire separations shall be in accordance with the NFCC and Clause 6 of this Standard.		Equivalent
5.7.5.2.2*	The turbine generator building (hall) shall be designed and separated from other areas of the plant such that a fire involving the turbine generator area will not (a) spread to other areas; and (b) result in progressive structural collapse.	CSA N293-07 : Clause 5.7.5.2.2* The turbine generator building (hall) shall be designed and separated from other areas of the plant such that a fire involving the turbine generator area will not (a) spread to other areas; and (b) result in progressive structural collapse.		Equivalent
5.7.6*	The production and propagation of smoke and hot gases and their effects on occupants, plant equipment, and building structures shall be addressed in the FPA. Where smoke and heat venting are deemed necessary by the FPA, the design shall be in accordance with Clause 6. Smoke management related to the control room complex shall be in accordance with Clause 5.7.8.5.	CSA N293-07 : Clause 5.7.6* The production and propagation of smoke and hot gases and their effects on occupants, plant equipment, and building structures shall be addressed in the FHA. Where smoke and heat venting are deemed necessary by the FHA, the design shall be in accordance with Clause 6. Smoke management related to the control room complex shall be in accordance with Clause 5.7.8.6.	N293-07 cited an FSSA, while N293-12 more generally cites the FPA (consisting of CCR, FHA & FSSA)	Equivalent
5.7.7		CSA N293-07 : Clause 5.7.7		Equivalent
5.7.7.1*	Fires that are caused by an earthquake and have an impact on nuclear safety shall be assessed and addressed. These fires shall be prevented, suppressed, or contained such that sufficient SSCs remain available to meet the nuclear safety criteria in Clause 5.4, taking into account the potential failure of structures and systems that are not qualified to withstand earthquakes. Fire suppression systems and fire separations credited for earthquakes shall be designed to remain functional following an earthquake.	CSA N293-07 : Clause 5.7.7.1* Fires that are caused by an earthquake and have an impact on nuclear safety shall be assessed and addressed. These fires shall be prevented, suppressed, or contained such that sufficient structures, systems, and components remain available to meet the nuclear safety criteria in Clause 5.4, taking into account the potential failure of structures and systems that are not qualified to withstand earthquakes. Fire suppression systems and fire separations credited for earthquakes shall be designed to remain functional following an earthquake.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.7.7.2*	Where the failure (both direct and consequential) of fire protection systems or fire separations can cause the failure of the plant SSCs required to perform nuclear safety functions after an earthquake, these fire protection systems and fire separations shall be seismically qualified to prevent such failures.	CSA N293-07 : Clause 5.7.7.2 Where the failure (both direct and consequential) of fire protection systems or fire separations can cause the failure of the plant structures, systems, and components required to perform nuclear safety functions after an earthquake, these fire protection systems and fire separations shall be seismically qualified to prevent such failures.		Equivalent
5.7.7.3*	Regardless of the results of the assessment required by Clause 5.7.7.1, manual fire suppression shall be provided for fires that might occur following an earthquake but are not a direct result of an earthquake.	CSA N293-07 : Clause 5.7.7.3 Regardless of the results of the assessment required by Clause 5.7.7.1, manual fire suppression shall be provided for fires that might occur following an earthquake but are not a direct result of an earthquake.		Equivalent
5.7.7.4*	Fire suppression systems that are designed to function after an earthquake shall be provided with services (e.g., power, water, compressed air) that are qualified to remain functional following the design basis earthquake defined for the plant.	CSA N293-07 : Clause 5.7.7.4 Fire-extinguishing systems that are designed to function after an earthquake shall be provided with services (e.g., power, water, compressed air) that are qualified to remain functional following the design basis earthquake defined for the plant.		Equivalent
5.7.7.5	Where manual activation of fire suppression and smoke control systems is credited in the assessment required by Clause 5.7.7.1, control areas and the paths leading to them shall be seismically qualified to remain accessible.	CSA N293-07 : Clause 5.7.7.5 Where manual activation of fire suppression and smoke control systems is credited in the assessment required by Clause 5.7.7.1, control areas and the paths leading to them shall be seismically qualified to remain accessible.		Equivalent
5.7.8*		CSA N293-07 : Clause 5.7.8		Equivalent
5.7.8.1	The control room complex shall be separated from adjoining areas by a fire separation with a fire resistance rating as specified in Clause 6.7.1.1.	CSA N293-07 : Clause 5.7.8.2 The control room complex shall be separated from adjoining areas by a fire separation with a fire resistance rating appropriate for the applicable fire hazards. Note: See Clause 6.7.1.1.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.7.8.2	Special consideration shall be given to the prevention of fires in the control room complex. Note: See Clause 6.8 for fire prevention requirements.	CSA N293-07 : Clause 5.7.8.3 Special consideration shall be given to the prevention of fires in the control room complex. Note: See Clause 6.8 for fire prevention requirements.		Equivalent
5.7.8.3*	The control room complex shall be equipped with means to detect fires at their incipient stages.	CSA N293-07 : Clause 5.7.8.4* The control room complex shall be equipped with means to detect fires at their incipient stages.		Equivalent
5.7.8.4*	Means shall be provided to limit the spread of fire across equipment within the control room complex. Areas of the control room complex that lie outside the control room, control equipment room(s), and control computer room shall be protected by automatic fire suppression systems and shall be separated from the control room and the control equipment room(s) by a fire separation.	CSA N293-07 : Clause 5.7.8.5* Means shall be provided to limit the spread of fire across equipment within the control room complex. Areas of the control room complex that lie outside the control room, control equipment room(s), and control computer room shall be protected by automatic fire suppression systems and shall be separated from the control room and the control equipment room(s) by a fire separation.		Equivalent
5.7.8.5*	A smoke management system shall be provided to ensure that (a) the control room remains habitable throughout all fires that are external to the control room complex; and (b) in the event of a fire within the control room complex, including a fire in the control room, the control room remains habitable for a period of time sufficient to enable safe transfer of control to the SCA.	CSA N293-07 : Clause 5.7.8.6* A smoke management system shall be provided to ensure that (a) the control room remains habitable throughout all fires that are external to the control room complex; and (b) in the event of a fire within the control room complex, including a fire in the control room, the control room remains habitable for a period of time sufficient to enable safe transfer of control to the SCA.		Equivalent
5.8		CSA N293-07 : Clause 5.8		Equivalent
5.8.1	The licensee of the plant shall prepare a policy document that establishes and outlines the implementation of a fire protection program. The policy document shall define management's authority and responsibilities.	CSA N293-07 : Clause 5.8.1 The licensee of the plant shall prepare a policy document that establishes and outlines the implementation of a fire protection program. The policy document shall define management's authority and responsibilities.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.8.2	A fire protection program shall be developed and implemented in a coordinated manner that takes into account the various fire protection activities of different engineering disciplines, functional groups, and other organizations.	CSA N293-07 : Clause 5.8.2 A fire protection program shall be developed and implemented in a coordinated manner that takes into account the various fire protection activities of different engineering disciplines, functional groups, and other organizations.		Equivalent
5.8.3*	The fire protection program shall detail how the program will be implemented, managed, monitored, and modified during each phase of the life cycle of a plant. Activities specified in the fire protection program for each phase shall include (a) specifying the fire protection organization and their responsibilities; (b) establishing the standards and procedures for design, analysis, and operation, including impairments and compensatory measures; (c) providing staff and training to carry out fire protection responsibilities; (d) preparing and maintaining the FPA; (e) preparing and maintaining documentation of the fire protection design of the plant; (f) managing changes that affect fire protection; (g) managing the storage and handling of flammable liquids, combustible liquids, and compressed gases; (h) housekeeping (including combustible waste); (i) inspection, testing, and maintenance of fire protection design features and equipment; (j) controlling transient combustible material and non-combustible material; (k) managing fire safety during work activities; (l) fire reporting; (m) controlling sources of ignition; (n) preparing pre-fire plans;	CSA N293-07 : Clause 5.8.3* The fire protection program shall detail how the program will be implemented, managed, monitored, and modified during each phase of the life cycle of a plant. Activities specified in the fire protection program for each phase shall include (a) specifying the fire protection organization and their responsibilities; (b) establishing the standards and procedures for design, analysis, and operation, including impairments and compensator)/ measures; (c) providing staff and training to carry out fire protection responsibilities; (d) preparing and maintaining the FHA; (e) preparing and maintaining documentation of the fire protection design of the plane (f) managing changes that affect fire protection; (g) managing the storage and handling of flammable liquids, combustible liquids, and compressed gases; (h) housekeeping; (i) inspection, testing, and maintenance of fire protection design features and equipment; (j) controlling transient combustible material and non-combustible material; (k) managing fire safety during work activities; (l) fire reporting; (m) controlling sources of ignition;		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
	(o) conducting drills; and (p) providing quality assurance for the activities outlined in Items (a) to (o).	(n) preparing pre-fire plans; (o) conducting drills; and (p) providing quality assurance for the activities outlined in Items (a) to (o).		
5.8.4	Fire safety plans shall be developed and implemented in accordance with the requirements of the NFCC and shall address the life cycle of the plant.	CSA N293-07 : Clause 5.8.4 Fire safety plans shall be developed and implemented in accordance with the requirements of the NFCC and shall address the life cycle of the plant.		Equivalent
5.8.5*	All fires shall be reported and shall be investigated with respect to any damage to SSCs, including whether such damage could affect future performance.	CSA N293-07 : Clause 5.8.5* All fires shall be reported and shall be investigated with respect to any damage to structures and equipment, including whether such damage could affect future performance.		Equivalent
5.8.6	All activities or work shall be managed in accordance with the fire protection goals of this Standard.	CSA N293-07 : Clause 5.8.6 All activities or work shall be managed in accordance with the fire protection goals of this Standard.		Equivalent
5.9*		CSA N293-07 : Clause 5.9*		Equivalent
5.9.1*	All proposed modifications to operating plants shall be assessed to determine their potential impact on fire safety. This assessment shall be completed by the design authority in accordance with Clause 5.9.2.	CSA N293-07 : Clause 5.9.1* All proposed modifications to operating plants shall be assessed to determine their potential impact on fire safety. This assessment shall be completed by the design authority in accordance with Clause 5.9.2.		Equivalent
5.9.2*		CSA N293-07 : Clause 5.9.2*		Equivalent
5.9.2.1	Assessments of modifications shall be performed in two stages, in accordance with Clauses 5.9.2.2 to 5.9.2.8.	CSA N293-07 : Clause 5.9.2.1 Assessments of modifications shall be performed in two stages, in accordance with Clauses 5.9.2.2 to 5.9.2.8.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.9.2.2	The first stage shall be a screening assessment of all modifications for their potential to affect (a) the established design basis of fire protection SSCs; or (b) the fire protection goals and criteria of Clauses 5.2 to 5.5. Note: This Clause does not apply to economic goals beyond those established by the licensee in accordance with Clause 5.2, Item (c).	CSA N293-07 : Clause 5.9.2.2 The first stage shall be a screening assessment of all modifications for their potential to affect (a) the established design basis of fire protection systems, structures, or components; or (b) the fire protection goals and criteria of Clauses 5.2 to 5.5. Note: This Clause does not apply to economic goals beyond those established by the licensee in accordance with Clause 5.2, Item (c).		Equivalent
5.9.2.3	The second stage shall be a detailed assessment of those modifications whose first-stage screening assessment indicates a potential to affect fire protection design basis, goals, or criteria.	CSA N293-07 : Clause 5.9.2.3 The second stage shall be a detailed assessment of those modifications whose first stage screening assessment indicates a potential to affect fire protection design basis, goals, or criteria.		Equivalent
5.9.2.4	Modifications for which the first-stage assessment indicates a potential impact on fire protection design basis, goals, or criteria shall be subject to a qualified third-party review and the review shall be submitted to the AHJ. Note: The purpose of this review is to provide assurance that the modification will not adversely affect the fire protection design basis, goals, or criteria and to verify compliance with this Standard.	CSA N293-07 : Clause 5.9.2.4 Modifications for which the first stage assessment indicates a potential impact on fire protection design basis, goals, or criteria shall be subject to a qualified third party review and the review shall be submitted to the AHJ. Note: The purpose of this review is to provide assurance that the modification will not adversely affect the fire protection design basis, goals, or criteria and to verify compliance with this Standard.		Equivalent
5.9.2.5	Modifications for which the first-stage assessment indicates no potential impact on fire protection goals shall not be subject to any further qualified third-party review or require submission to the AHJ.	CSA N293-07 : Clause 5.9.2.5 Modifications for which the first stage assessment indicates no potential impact on fire protection goals shall not be subject to any further qualified third party review or require submission to the AHJ.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
5.9.2.6	All third-party reviews shall be conducted by qualified persons from organizations whose management and financial operations are independent of the design organization. Licensees may, with the concurrence of the AHJ, use their qualified design staff, provided that it can be demonstrated that the appropriate level of independence can be maintained.	CSA N293-07 : Clause 5.9.2.6 All third party reviews shall be conducted by qualified persons from organizations whose management and financial operations are independent of the design organization. Licensees may, with the concurrence of the AHJ, use their qualified design staff, provided that it can be demonstrated that the appropriate level of independence can be maintained.		Equivalent
5.9.2.7	Modifications for which the first-stage assessment indicates a potential impact on fire protection design basis, goals, or criteria shall be considered as new construction for the application of required Codes and Standards.	CSA N293-07 : Clause 5.9.2.7 Modifications for which the first stage assessment indicates a potential impact on fire protection design basis, goals, or criteria shall be considered as new construction for the application of required Codes and Standards.		Equivalent
5.9.2.8	All assessments carried out in accordance with Clause 5.9 shall be maintained as permanent plant records.	CSA N293-07 : Clause 5.9.2.8 All assessments carried out in accordance with Clause 5.9 shall be maintained as permanent plant records.		Equivalent
5.10*	The fire protection program for the life cycle of a plant shall comply with the quality assurance requirements of CSA N286. In addition, (a) periodic audits shall be performed to ensure that the fire protection program is adequate and is being implemented in accordance with Clause 8; and (b) the licensee shall establish a systematic approach to staff training that defines the qualifications required for the various responsibilities under the fire protection program.	CSA N293-07 : Clause 5.10* The fire protection program for the life cycle of a plant shall comply with the quality assurance requirements of CSA N286. In addition, (a) periodic audits shall be performed to ensure that the fire protection program is adequate and is being implemented in accordance with Clause 8; and (b) the licensee shall establish a systematic approach to staff training that defines the qualifications required for the various responsibilities under the fire protection program.		Equivalent
6				Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.1	Clause 6 specifies design requirements for the prevention and control of fires, the mitigation of fire hazards, and the protection of plant occupants, equipment, and structures. Clause 6 also specifies some of the means to achieve the nuclear safety goals, objectives, and criteria of Clause 5.	CSA N293-07 : Clause 6.1 Clause 6 specifies design requirements for the prevention and control of fires, the mitigation of fire hazards, and the protection of plant occupants, equipment, and structures. Clause 6 also specifies some of the means to achieve the nuclear safety goals, objectives, and criteria of Clause 5.		Equivalent
6.2		CSA N293-07 : Clause 6.2		Equivalent
6.2.1*	To ensure that the nuclear safety objectives stated in Clause 5.4.1 are satisfied, the plant shall be provided with redundant fire safe shutdown systems. These systems shall be functionally independent and physically separated such that at least one group is able to perform the required safety functions in the event of a fire.	CSA N293-07 : Clause 6.2.1* To ensure that the nuclear safety objectives stated in Clause 5.4 are satisfied, the plant shall be provided with redundant fire safe shutdown systems. These systems shall be functionally independent and physically separated such that at least one group is able to perform the required safety functions in the event of a fire.	N293-07 clause 6.2.1 refers to the nuclear safety objectives in clause 5.4, while N293-12 refers to the objectives in Clause 5.4.1. These references are equivalent, since the only specification of nuclear safety objectives in clause 5.4 is in subclause 5.4.1.	Equivalent
6.2.2*	Fire mitigation measures shall include one or more of the following: (a) firewalls; (b) fire separations; (c) spatial separations; (d) heat shields; (e) smoke and heat control; (f) firestop systems; and (g) fire-resistant coatings.	CSA N293-07 : Clause 6.2.2* Fire mitigation measures shall include one or more of the following: (a) firewalls; (b) fire separations; (c) spatial separations; (d) heat shields; (e) smoke and heat control; (f) firestop systems; and (g) fire-resistant coatings.		Equivalent
6.3*		CSA N293-07 : Clause 6.3*		Equivalent
6.3.1		CSA N293-07 : Clause 6.3.1		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.3.1.1*	The separation of redundant fire safe shutdown systems required by Clause 6.2.1 shall be provided by (a) fire barriers; or (b) spatial separations, in combination with the compensatory measures specified in Clause 6.3.3.3.	CSA N293-07 : Clause 6.3.1.1* The separation of redundant fire safe shutdown systems required by Clause 6.2.1 shall be provided by (a) fire barriers; or (b) spatial separations, in combination with the compensatory measures specified in Clause 6.3.3.3.		Equivalent
6.3.1.2	Except as permitted in Clause 6.3.1.3, separation between redundant fire safe shutdown systems shall be provided by fire barriers meeting the requirements of Clause 6.3.1.4.	CSA N293-07 : Clause 6.3.1.2 Except as permitted in Clause 6.3.1.3, separation between redundant fire safe shutdown systems shall be provided by fire barriers meeting the requirements of Clause 6.3.1.4.		Equivalent
6.3.1.3*	Where redundant fire safe shutdown systems are located in the same fire compartment and it is impractical to separate them as required in Clause 6.3.1.1, combustible materials within the fire compartment shall be limited to the combustible materials associated with the SSCs needed for operation.	CSA N293-07 : Clause 6.3.1.3* Where redundant fire safe shutdown systems are located in the same fire compartment and it is impractical to separate them as required in Clause 6.3.1.1, combustible materials within the fire compartment shall be limited to the combustible materials associated with the structures, systems, and components needed for operation.		Equivalent
6.3.1.4*	The fire resistance rating of the separation specified in Item (a) of Clause 6.3.1.1 shall be (a) 3 h; or (b) a lower rating determined by the FPA, when the fire separation is provided in conjunction with an automatic fire suppression system.	CSA N293-07 : Clause 6.3.1.4* The fire resistance rating of the separation specified in Item (a) of Clause 6.3.1.1 shall be (a) 3h; or (b) a lower rating determined by the FHA, when the fire separation is provided in conjunction with an automatic fire suppression system.	While N293-07 Clause 6.3.1.4 refers to determination of a fire resistance rating in an FHA, N293-12 Clause 6.3.14 refers more generally to determination of the rating in an FPA, which includes the FHA. So the two clauses are equivalent in intent.	Equivalent
6.3.1.5*	Where fire separations are used for the safety of essential staff or the protection of safety related systems, closures and firestops shall have a fire protection rating equal to the fire resistance rating of the separation.	CSA N293-07 : Clause 6.3.1.5* Where fire separations are used for the safety of essential staff or the protection of nuclear safety components, closures and firestops shall have a fire protection rating equal to the fire resistance rating of the separation.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.3.2		CSA N293-07 : Clause 6.3.2		Equivalent
6.3.2.1	The structure housing the turbine generator and associated ancillary process equipment (commonly referred to as the turbine generator building or turbine generator hall) may be considered a separate building as defined in the NBCC, provided that the structure is separated from other buildings or structures by a firewall or by a distance that meets the spatial separation and exposure protection requirements of the NBCC.	CSA N293-07 : Clause 6.3.2.1 The structure housing the turbine generator and associated ancillary process equipment (commonly referred to as the turbine generator building or turbine generator hall) may be considered a separate building as defined in the NBCC, provided that the structure is separated from other buildings or structures by a distance that meets the spatial separation and exposure protection requirements of the NBCC.		Equivalent
6.3.2.2*	The structure housing the turbine generator and associated ancillary process equipment shall be separated from adjacent rooms and areas by a fire separation with a fire resistance rating not less than 3 h.	CSA N293-07 : Clause 6.3.2.2* The structure housing the turbine generator and associated ancillary process equipment shall be separated from adjacent rooms and areas by a fire separation with a fire resistance rating not less than 3 h.		Equivalent
6.3.2.3	The structure housing the turbine generator and associated ancillary process equipment shall be protected against progressive structural collapse. Except as permitted by Clause 6.3.2.4, structural collapse due to fire shall be prevented by limiting the fire loading or protecting the supporting structure with measures such as insulation, sprinklers, or heat removal systems.	CSA N293-07 : Clause 6.3.2.3 The structure housing the turbine generator and associated ancillary process equipment shall be protected against progressive structural collapse. Except as permitted by Clause 6.3.2.4, structural collapse due to fire shall be prevented by limiting the fire loading or protecting the supporting structure with measures such as insulation, sprinklers, or heat removal systems.		Equivalent
6.3.2.4*	The requirements of Clauses 6.3.2.2 and 6.3.2.3 may be addressed by separating the structure housing the turbine generator and associated ancillary process equipment from adjacent rooms and areas using an intervening firewall constructed in accordance with the NBCC. However, for application of other NBCC requirements, the firewall shall be considered a fire separation.	CSA N293-07 : Clause 6.3.2.4* The requirements of Clauses 6.3.2.2 and 6.3.2.3 may be addressed by separating the structure housing the turbine generator and associated ancillary process equipment from adjacent rooms and areas using an intervening firewall constructed in accordance with the NBCC. However, for application of other NBCC requirements, the firewall shall be considered a fire separation.		Equivalent
6.3.3		CSA N293-07 : Clause 6.3.3		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.3.3.1*	Except as required by Clause 6.3.3.3, spatial separation, in combination with additional compensatory measures, may be used instead of fire barriers where the installation of a fire barrier (a) is impractical due to the design of the space or the presence of process equipment and services; or (b) would interfere with nuclear operation or pose a risk to nuclear safety.	CSA N293-07 : Clause 6.3.3.1* Except as required by Clause 6.3.3.3, spatial separation, in combination with additional compensatory measures, may be used instead of fire barriers where the installation of a fire barrier (a) is impractical due to the design of the space or the presence of process equipment and services; or (b) would interfere with nuclear operation or pose a risk to nuclear safety.		Equivalent
6.3.3.2	Spatial separation shall not be used to meet the egress and firewall requirements of the NBCC, except for inside the containment structure.	CSA N293-07 : Clause 6.3.3.2 Spatial separation shall not be used to meet the egress and firewall requirements of the NBCC, except for inside the containment structure.		Equivalent
6.3.3.3*	Where spatial separation is used to satisfy Clause 6.3.3.1, additional compensatory measures shall be used as follows: (a) There shall be no intervening combustible materials, including combustible materials that might be present due to component failure, that can spread a fire across the spatial separation. (b) The damage to more than one group of fire safe shutdown systems located within the same fire compartment that is due to the effects of fire or products of combustion across the spatial separation shall be assessed and prevented. (c) Fire detection and suppression and/or other fire protection measures shall be provided in accordance with the FPA. The electrical power supply to mechanical equipment shall meet the requirements of Clause 7.2.1.13.	CSA N293-07 : Clause 6.3.3.3* Where spatial separation is used to satisfy Clause 6.3.3.1, additional compensatory measures shall be used as follows: (a) there shall be no intervening combustible materials, including combustible materials that might be present due to component failure, that can spread a fire across the spatial separation; (b) the damage to more than one group of fire safe shutdown systems located within the same fire compartment that is due to the effects of fire or products of combustion across the spatial separation shall be assessed and prevented; and (c) fire detection and suppression and/or other fire protection measures shall be provided in accordance with the FHA. The electrical power supply to mechanical equipment shall meet the requirements of Clause 7.2.1.13.	While N293-07 Clause 6.3.3.3 refers to fire protection measures in accordance with the FHA, N293-12 Clause 6.3.3.3 refers more generally to fire protection measurements in accordance with the FPA, which includes the FHA. So the two clauses are equivalent in intent.	Equivalent
6.4*		CSA N293-07 : Clause 6.4*		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.4.1*	Where a fire hazard is located in the same fire compartment as a fire safe shutdown system or its components, and the fire hazard has the potential to damage or disable the system or its components, fire barriers or spatial separation (as required by Clause 6.2.2) shall be provided.	CSA N293-07 : Clause 6.4.1* Where a fire hazard is located in the same fire compartment as a fire safe shutdown system or its components, and the fire hazard has the potential to damage or disable the system or its components, fire barriers or spatial separation (as required by Clause 6.2.2) shall be provided.		Equivalent
6.4.2*	Physical or spatial separation between redundant equipment within a fire safe shutdown system shall be provided. The extent of the separation required shall be based on the fire hazards and the vulnerability of the components, as identified in the FPA.	CSA N293-07 : Clause 6.4.2* Physical or spatial separation between redundant equipment within a fire safe shutdown system shall be provided. The extent of the separation required shall be based on the fire hazards and the vulnerability of the components, as identified in the FSSA.	While N293-07 Clause 6.4.2 refers to separation requirements in accordance with the FSSA, N293-12 Clause 6.4.2 refers more generally to separation requirements in accordance with the FPA, which includes the FSSA. So the two clauses are equivalent in intent.	Equivalent
6.5		CSA N293-07 : Clause 6.5		Equivalent
6.5.1		CSA N293-07 : Clause 6.5.1		Equivalent
6.5.1.1	An area or room used for the storage or handling of combustible materials or flammable or combustible liquids, solids, or gases shall be separated from the remainder of the building by a fire separation having a minimum 2 hour resistance rating.	CSA N293-07 : Clause 6.5.1.1 An area or room used for the storage or handling of combustible materials or flammable or combustible liquids, solids, or gases shall be separated from the remainder of the building by a fire separation. CSA N293-07 : Clause 6.5.1.3 Fire separation shall have a minimum fire resistance rating of 2 h when required by Clause 6.5.1.1 or when the area is used for storing radioactive materials.	The intent of CSA N293-07 Clause 6.5.1.1 in conjunction with 6.5.1.3 is identical to that of CSA N293-12 Clause 6.5.1.1	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.5.1.2	The fire resistance rating of the fire separation required by Clause 6.5.1.1 shall be determined in accordance with the NBCC, the NFCC, or the FPA, whichever is most stringent.	CSA N293-07 : Clause 6.5.1.2 The fire resistance rating of the fire separation required by Clause 6.5.1.1 shall be determined in accordance with the NBCC, the NFCC, or the FHA, whichever is most stringent.	While N293-07 Clause 6.5.1.2 refers to fire resistance ratings in accordance with the FHA, N293-12 Clause 6.5.1.2 refers more generally to fire resistance ratings in accordance with the FPA, which includes the FHA. So the two clauses are equivalent in intent.	Equivalent
6.5.2		CSA N293-07 : Clause 6.5.2		Equivalent
6.5.2.1	Piping, tubing, wiring, cables, raceways, structural supports, and other equipment that penetrates a fire separation shall be sealed by a firestop system to provide a fire protection rating equivalent to the fire resistance rating of the fire separation.	CSA N293-07 : Clause 6.5.2.1 Piping, tubing, wiring, cables, raceways, and other equipment that penetrates a fire separation shall be sealed by a firestop system to provide a fire protection rating equivalent to the fire separation.	While N293-07 Clause 6.5.2.1 specifies "piping, tubing, ... raceways, and other equipment that penetrates a fire separation ...", N293-12 Clause 6.5.2.1 specifies "piping, tubing, ... raceways, structural supports and other equipment that ...". Structural supports are obvious examples of equipment that could penetrate a fire separation, so the intent of both clauses is equivalent.	Equivalent
6.5.2.2*	Penetration firestop systems shall have an FH rating in accordance with CAN/ULC-S115.	CSA N293-07 : Clause 6.5.2.2* Penetration firestop systems shall have an FH rating in accordance with CAN/ULC-5115.		Equivalent
6.5.2.3*	All joints in a fire separation shall be sealed by a firestop system to provide a fire resistance rating equivalent to the fire resistance rating of the fire separation. Joint firestop systems shall have an FTH rating in accordance with CAN/ULC-S115.	CSA N293-07 : Clause 6.5.2.3* All joints in a fire separation shall be sealed by a firestop system to provide a fire resistance rating equivalent to the fire separation. Joint firestop systems shall have an FTH rating in accordance with CAN/ULC-5115.		Equivalent
6.5.2.4	Plant design documentation shall include a record of all firestops, including their locations, fire rating requirements, and methods of qualification (e.g., conformance to CAN/ULC S-115).	CSA N293-07 : Clause 6.5.2.4 Plant design documentation shall include a record of all firestops, including their locations, fire rating requirements, and methods of qualification (e.g., conformance to CAN/ULC 5-115).		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.5.3		CSA N293-07 : Clause 6.5.3		Equivalent
6.5.3.1	Spatial separation or fire barriers shall be provided between cable trays and risers to reduce the potential for fire spread and to allow sufficient space for firefighting.	CSA N293-07 : Clause 6.5.3.1* Spatial separation or fire barriers shall be provided between cable trays and risers to reduce the potential for fire spread and to allow sufficient space for firefighting.		Equivalent
6.5.3.2*	Where fire barriers are adjacent to or between cable trays and risers, ventilation or other measures shall be provided for cables to ensure that the design limits for temperature are not exceeded.	CSA N293-07 : Clause 6.5.3.2 Where fire barriers are adjacent to or between cable trays and risers, ventilation or other measures shall be provided for cables to ensure that the design limits for temperature are not exceeded.		Equivalent
6.5.3.3	Cable trays and risers shall be located away from fire hazards to reduce the potential for cables to be ignited or damaged by fire.	CSA N293-07 : Clause 6.5.3.3 Cable trays and risers shall be located away from fire hazards to reduce the potential for cables to be ignited or damaged by fire.		Equivalent
6.5.4*		CSA N293-07 : Clause 6.5.4*		Equivalent
6.5.4.1	To ensure the integrity of fire separation assemblies, structures supporting fire separations shall have a fire resistance rating greater than or equal to the fire separation being supported. Note: The structures supporting fire separations can include fire separation assemblies, load-bearing walls, columns, beams, and arches.	CSA N293-07 : Clause 6.5.4.1 To ensure the integrity of fire separation assemblies, structures supporting fire separations shall have a fire resistance rating greater than or equal to the fire separation being supported. Note: The structures supporting fire separations can include fire separation assemblies, load-bearing walls, columns, beams, and arches.		Equivalent
6.5.4.2*	The fire protection design of the plant shall assess the impact of fire on building structures and equipment supports. Structural failures during fires shall be prevented where such failures could create unacceptable consequences for any of the fire protection goals.	CSA N293-07 : Clause 6.5.4.2* The fire protection design of the plant shall assess the impact of fire on building structures and equipment supports. Structural failures during fires shall be prevented where such failures could create unacceptable consequences for any of the fire protection goals.		Equivalent
6.6		CSA N293-07 : Clause 6.6		Equivalent
6.6.1		CSA N293-07 : Clause 6.6.1		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.6.1.1	Interior aisles, corridors, stairs, walkways, catwalks, and platforms used for egress shall meet NBCC requirements for width, height, treads, risers, guards, handrails, and headroom.	CSA N293-07 : Clause 6.6.1.1 Interior aisles, corridors, stairs, walkways, catwalks, and platforms used for egress shall meet NBCC requirements for width, height, treads, risers, guards, handrails, and headroom.		Equivalent
6.6.1.2	Emergency and exit lighting shall be provided in airlocks and transfer chambers, in addition to the areas required by the NBCC.	CSA N293-07 : Clause 6.6.1.2 Emergency and exit lighting shall be provided in airlocks and transfer chambers, in addition to the areas required by the NBCC.		Equivalent
6.6.1.3	Emergency lighting shall be provided with a minimum 2 h emergency power supply.	CSA N293-07 : Clause 6.6.1.3 Emergency lighting shall be provided with a minimum 2 h emergency power supply.		Equivalent
6.6.1.4	Except as required in Clause 6.7.2.2, emergency lighting shall provide a minimum average lighting level of 10 lx and a minimum of 1 lx measured at the floor or tread level.	CSA N293-07 : Clause 6.6.1.4 Except as required in Clause 6.7.2.2, emergency lighting shall provide a minimum average lighting level of 10 lx and a minimum of 1 lx measured at the floor or tread level.		Equivalent
6.6.1.5*	Egress routes shall be clearly identified with exit signage, other specialized signage, emergency lighting, or floor demarcation so that exits can be readily located by occupants.	CSA N293-07 : Clause 6.6.1.5* Egress routes shall be clearly identified with exit signage, other specialized signage, emergency lighting, or floor demarcation so that exits can be readily located by occupants.		Equivalent
6.6.2*		CSA N293-07 : Clause 6.6.2*		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.6.2.1	Where compensatory measures acceptable to the AHJ are provided to protect occupants of the containment structure, the following deviations from the NBCC shall be permitted: (a) Containment structure airlocks are not required to meet the NBCC exit requirements for (i) fire protection rating; (ii) fire resistance rating; (iii) pressurization; (iv) door swing; (v) door release; and (vi) travel distance. (b) The fire separation between floor assemblies that is required by the NBCC, Division B, Articles 3.2.2.73 to 3.2.2.75, does not apply. (c) Open stairways may serve as access to an exit.	CSA N293-07 : Clause 6.6.2.1 Where compensatory measures acceptable to the AHJ are provided to protect occupants of the containment structure, the following deviations from the NBCC shall be permitted: (a) Containment structure airlocks are not required to meet the NBCC exit requirements for (i) fire protection rating; (ii) fire resistance rating; (iii) pressurization; (iv) door swing; (v) door release; and (vi) travel distance. (b) The fire separation between floor assemblies that is required by the NBCC, Division B, Articles 3.2.2.73 to 3.2.2.75, does not apply. (c) Open stairways may serve as access to an exit.		Equivalent
6.6.2.2		CSA N293-07 : Clause 6.6.2.2		Equivalent
6.6.2.2.1*	A minimum of two means of egress from the reactor containment structure shall be provided and shall be located such that one remains available should the other become inaccessible due to fire.	CSA N293-07 : Clause 6.6.2.2.1* A minimum of two means of egress from the reactor containment structure shall be provided and shall be located such that one remains available should the other become inaccessible due to fire.		Equivalent
6.6.2.2.2	Airlock doors shall be designed to remain operable in the event of a fire within the containment structure.	CSA N293-07 : Clause 6.6.2.2.2 Airlock doors shall be designed to remain operable in the event of a fire within the containment structure.		Equivalent
6.6.2.2.3	For the reactor containment structure, the travel distance to an exit may be measured from the egress door of the containment structure.	CSA N293-07 : Clause 6.6.2.2.3 For the reactor containment structure, the travel distance to an exit may be measured from the egress door of the containment structure.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.6.3*	Where compensatory measures acceptable to the AHJ are provided for window and access panel openings, the requirements of the NBCC, Division B, Sentence 3.2.5.1(1), shall not apply.	CSA N293-07 : Clause 6.6.3* Where compensatory measures acceptable to the AHJ are provided for window and access panel openings, the requirements of the NBCC, Division B, Sentence 3.2.5.1(1), shall not apply.		Equivalent
6.7		CSA N293-07 : Clause 6.7		Equivalent
6.7.1		CSA N293-07 : Clause 6.7.1		Equivalent
6.7.1.1	The control room complex shall be separated from the remainder of the building by a fire separation with a 2 h fire resistance rating, unless a greater fire resistance rating is required by the FPA.	CSA N293-07 : Clause 6.7.1.1 The control room complex shall be separated from the remainder of the building by a fire separation with a 2 h fire resistance rating, unless a greater fire resistance rating is required by the FHA.	While N293-07 Clause 6.7.1.1 refers to fire resistance ratings in accordance with the FHA, N293-12 Clause 6.7.1.1 refers more generally to fire resistance ratings in accordance with the FPA, which includes the FHA. So the two clauses are equivalent in intent.	Equivalent
6.7.1.2*	The control room complex shall be designed to minimize smoke infiltration during a fire.	CSA N293-07 : Clause 6.7.1.2* The control room complex shall be designed to minimize smoke infiltration during a fire.		Equivalent
6.7.1.3	The control room complex shall be protected so that, for a 2 h period following the start of a fire outside the control room complex, it will not contain more than 1% of contaminated air (i.e., products of combustion) by volume.	CSA N293-07 : Clause 6.7.1.3* The control room complex shall be protected so that, for a 2 h period following the start of a fire outside the control room complex, it will not contain more than 1% of contaminated air (i.e., products of combustion) by volume.		Equivalent
6.7.2*		CSA N293-07 : Clause 6.7.2*		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.7.2.1*	At least two travel routes shall be provided from the main control room to the secondary control room. These routes shall (a) not be subject to common cause failure; (b) be designed and protected in accordance with the width, height, fire resistance rating, and integrity requirements specified for exits in the NBCC; (c) be designed to minimize smoke infiltration during a fire, such that the routes will not contain more than 1% of contaminated air; and (d) be provided with emergency lighting in accordance with the NBCC, Division B, Article 3.2.7.3. Note: Where a secondary control room operator has been assigned, protected travel routes are not necessary.	CSA N293-07 : Clause 6.7.2.1* At least two travel routes shall be provided from the main control room to the secondary control room. These routes shall (a) not be subject to common cause failure; (b) be designed and protected in accordance with the width, height, fire resistance rating, and integrity requirements specified for exits in the NBCC; (c) be designed to minimize smoke infiltration during a fire, such that the routes will not contain more than 1% of contaminated air; and (d) be provided with emergency lighting in accordance with the NBCC, Division B, Article 3.2.7.3. Note: Where a secondary control room operator has been assigned, protected travel routes are not necessary.		Equivalent
6.7.2.2	In areas required for emergency operator action, a minimum lighting level of 10 lx shall be provided at floor level.	CSA N293-07 : Clause 6.7.2.2 In areas required for emergency operator action, a minimum lighting level of 10 lx shall be provided.		Equivalent
6.8		CSA N293-07 : Clause 6.8		Equivalent
6.8.1*		CSA N293-07 : Clause 6.8.1		Equivalent
6.8.1.1	Buildings shall be constructed using non-combustible construction in accordance with the NBCC. Because limited amounts of combustible material are permitted by the NBCC in buildings of non-combustible construction, the requirements of Clause 6.8.1 are in addition to the NBCC requirements.	CSA N293-07 : Clause 6.8.1.1 Buildings shall be constructed using non-combustible materials in accordance with the NBCC. Because limited amounts of combustible material are permitted by the NBCC in buildings of non-combustible material construction, the requirements of Clause 6.8.1 are in addition to the NBCC requirements.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.8.1.2	Roof decks shall be of a type that does not propagate fire beneath the deck. Types in accordance with CAN/ULC-S126 or considered Class I metal deck as defined by Factory Mutual may be used. Roof covering shall not be readily ignitable when exposed to fire. Coverings in accordance with Class A requirements in CAN/ULC-S107 may be used.	CSA N293-07 : Clause 6.8.1.2 Roof decks shall be of a type that does not propagate fire beneath the deck. Types in accordance with CAN/ULC-S126 or considered Class I metal deck as defined by Factory Mutual may be used. Roof covering shall not be readily ignitable when exposed to fire. Coverings in accordance with Class A requirements in CAN/ULC-S107 may be used.		Equivalent
6.8.1.3*		CSA N293-07 : Clause 6.8.1.3*		Equivalent
6.8.1.3.1	The use of building fixtures containing combustible materials shall be minimized in plant buildings.	CSA N293-07 : Clause 6.8.1.3.1 The use of building fixtures containing combustible materials shall be minimized in plant buildings.		Equivalent
6.8.1.3.2*	Exposed foam plastics shall not be used as parts for buildings or fixtures.	CSA N293-07 : Clause 6.8.1.3.2 Exposed foam plastics shall not be used as parts for buildings or fixtures.		Equivalent
6.8.1.3.3	Shelves and racks designed for equipment installation and storage shall not be constructed of combustible materials.	CSA N293-07 : Clause 6.8.1.3.3 Shelves and racks designed for equipment installation and storage shall not be constructed of combustible materials.		Equivalent
6.8.1.4*	Interior finishes shall meet the following requirements: (a) Interior wall or ceiling finishes shall have a flame spread rating less than or equal to 25 and smoke development of less than 100 when tested in accordance with CAN/ULC-S102. (b) Interior floor finishes shall have a flame spread rating less than or equal to 300 and smoke development classification of less than 450 when tested in accordance with ASTM E648 and ASTM E662. (c) Epoxy liner on the containment wall shall have a flame spread rating less than or equal to 40 when tested in accordance with CAN/ULC-S102 or CAN/ULC-S102.2.	CSA N293-07 : Clause 6.8.1.4* Interior finishes shall meet the following requirements: (a) Interior wall or ceiling finishes shall have a flame spread rating less than or equal to 25 and smoke development of less than 100 when tested in accordance with CAN/ULC-S102. (b) Interior floor finishes shall have a Class 1 rating when tested in accordance with CAN/ULC-S102.2. (c) Epoxy liner on the containment wall shall have a flame spread rating less than or equal to 40 when tested in accordance with CAN/ULC-5102 or CAN/ULC-S102.2.	While N293-07 Clause 6.8.1.4 requirement (b) is that "Interior floor finishes shall have a Class 1 rating when tested in accordance with CAN/ULC-S102.2", N293-12 Clause 6.8.1.4 requirement (b) is more specific: "Interior floor finishes shall have a flame spread rating less than or equal to 300 and smoke development classification of less than 450 when tested in accordance with ASTM E648 and ASTM E662". The two clauses are equivalent in intent.	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.8.2		CSA N293-07 : Clause 6.8.2		Equivalent
6.8.2.1	Storage and laydown areas shall be appropriately located, sized, and equipped with fire protection to minimize the fire hazard they pose to nuclear and life safety.	CSA N293-07 : Clause 6.8.2.1 Storage and laydown areas shall be of adequate capacity, located appropriately, and equipped with adequate fire protection in order to minimize the fire hazard they pose to nuclear and life safety.		Equivalent
6.8.2.2	During the operation of the plant, transient materials shall be controlled so that they do not pose a hazard beyond the capabilities of existing fire protection measures. See Clause 8 for specific operational control measures.	CSA N293-07 : Clause 6.8.2.2 During the operation of the plant, transient materials shall be controlled so that they do not pose a hazard beyond the capabilities of existing fire protection measures. See Clause 8 for specific operational control measures.		Equivalent
6.8.2.3	Plant design shall incorporate storage facilities that can accommodate the greatest volume of transient combustible materials anticipated during operation and maintenance.	CSA N293-07 : Clause 6.8.2.3 Plant design shall incorporate storage facilities that can adequately accommodate the greatest volume of transient combustible materials anticipated during operation and maintenance.	While N293-07 Clause 6.8.2.3 refers to facilities that can "adequately accommodate" a volume, N293-12 Clause 6.8.2.3 refers to facilities that can "adequately accommodate" a volume. The two clauses are equivalent in intent.	Equivalent
6.8.2.4	Storage facilities shall be located so that fire within the facilities does not adversely impact safety-related equipment located nearby.	CSA N293-07 : Clause 6.8.2.4 Storage facilities shall be located so that fire within the facilities does not adversely impact safety-related equipment located nearby.		Equivalent
6.8.2.5*	The facility shall be provided with storage rooms, to minimize the need for the temporary storage or staging of materials outside of storage rooms in the containment structure, reactor auxiliary building, and control room complex.	CSA N293-07 : Clause 6.8.2.5* The facility shall be provided with adequately sized storage rooms, designed in accordance with this Standard, to eliminate the need for the temporary storage or staging of materials outside of storage rooms in the containment structure, reactor auxiliary building, and control room complex	While N293-07 Clause 6.8.2.5 refers to "adequately sized" storage rooms, N293-12 Clause 6.8.2.3 simply refers to storage rooms, without mention of adequacy of sizing. The two clauses are equivalent in intent.	Equivalent
6.8.3		CSA N293-07 : Clause 6.8.3		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.8.3.1	Air-handling ducts, duct connectors, and plenums shall be made of non-combustible materials.	CSA N293-07 : Clause 6.8.3.1 Air-handling ducts, duct connectors, and plenums shall be made of non-combustible materials.		Equivalent
6.8.3.2	Air filter media (excluding charcoal filters and high-efficiency particulate air [HEPA] filters) used in air-handling systems shall meet the combustibility requirements of Class 1 in accordance with CAN/ULC-S111.	CSA N293-07 : Clause 6.8.3.2 Air filter media (excluding charcoal filters and high-efficiency particulate air [HEPA] filters) used in air-handling systems shall meet the combustibility requirements of Class 1 in accordance with CAN/ULC-S111.		Equivalent
6.8.3.3	HEPA filters shall meet the combustibility requirements of ANSI/UL-586.	CSA N293-07 : Clause 6.8.3.3 HEPA filters shall meet the combustibility requirements of ANSI/UL-586.		Equivalent
6.8.3.4*	Fire protection for charcoal filters shall be provided to ensure that fires do not spread beyond the filter housing and to prevent the uncontrolled release of contamination into the atmosphere.	CSA N293-07 : Clause 6.8.3.4* Fire protection for charcoal filters shall be provided to ensure that fires do not spread beyond the filter housing and to prevent the uncontrolled release of contamination into the atmosphere.		Equivalent
6.8.4		CSA N293-07 : Clause 6.8.4		Equivalent
6.8.4.1*	Plant design shall minimize the use of plastics, wood, and other combustible materials in electrical equipment, cable raceways, and wiring racks.	CSA N293-07 : Clause 6.8.4.1* Plant design shall minimize the use of plastics, wood, and other combustible materials in electrical equipment, cable raceways, and wiring racks.		Equivalent
6.8.4.2*	Electric and control cabinets shall be designed to minimize flame spread across adjacent cabinets.	CSA N293-07 : Clause 6.8.4.2* Electric and control cabinets shall be designed to minimize flame spread across adjacent cabinets.		Equivalent
6.8.4.3	Electrical cable trays and conduits shall be constructed of non-combustible materials.	CSA N293-07 : Clause 6.8.4.3 Electrical cable trays and conduits shall be constructed of non-combustible materials.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.8.4.4*	Electrical cables shall have a limited flame spread rating and produce a low level of smoke and corrosive gases. The wires and cables shall exhibit a maximum vertical char of not more than 1.5 m when tested in conformance with Clause 4.11.4 of CSA C22.2 No. 0.3.	CSA N293-07 : Clause 6.8.4.4* Electrical cables shall have a limited flame spread rating and produce a low level of smoke and corrosive gases. The flame spread for electrical cables shall not be more than 1.5 m when tested in accordance with the flame and smoke test of CSA C22.2 No. 0.3.	While N293-07 Clause 6.8.4.4 states that "The flame spread for electrical cables shall not be more than 1.5 m when tested in accordance with the flame and smoke test of CSA C22.2 No. 0.3.", N293-12 Clause 6.8.4.4 more specifically states that "The wires and cables shall exhibit a maximum vertical char of not more than 1.5 m when tested in conformance with Clause 4.11.4 of CSA C22.2 No. 0.3." The two clauses are equivalent in intent.	Equivalent
6.8.5		CSA N293-07 : Clause 6.8.6		Equivalent
6.8.5.1	In addition to the requirements of the NFCC, the handling, use, and storage of flammable liquids and combustible liquids shall meet the requirements of Clauses 6.8.5.2 and 6.8.5.3.	CSA N293-07 : Clause 6.8.6.1 In addition to the requirements of the NFCC, the handling, use, and storage of flammable liquids and combustible liquids shall meet the requirements of Clauses 6.8.6.2 and 6.8.6.3.		Equivalent
6.8.5.2*	The use of flammable liquids and combustible liquids in equipment for hydraulic power, lubrication, heat transfer, and electrical insulation shall be minimized. Where they cannot be eliminated, preference shall be given to liquids with a higher flash point.	CSA N293-07 : Clause 6.8.6.2* The use of flammable liquids and combustible liquids in equipment for hydraulic power, lubrication, heat transfer, and electrical insulation shall be minimized. Where they cannot be eliminated, preference shall be given to liquids with a higher flash point.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.8.5.3*	Systems containing combustible liquids such as lubrication oils and hydraulic oils shall be designed to minimize leakage of these liquids. In locations where an uncontrolled leakage of the liquid could jeopardize fire safe shutdown systems, the design shall provide devices to collect, divert, and safely contain leakages from pressurized and non-pressurized components in order to prevent the ignition of the oil or limit the size of fire and achieve fire safe shutdown.	CSA N293-07 : Clause 6.8.6.3* Systems containing combustible liquids such as lubrication oils and hydraulic oils shall be designed to minimize leakage of these liquids. In locations where an uncontrolled leakage of the liquid could jeopardize fire safe shutdown systems, the design shall provide devices to collect, divert, and safely contain leakages from pressurized and non-pressurized components in order to prevent the ignition of the oil or limit the size of fire and achieve fire safe shutdown.		Equivalent
6.8.6		CSA N293-07 : Clause 6.8.7		Equivalent
6.8.6.1*	Systems containing hydrogen shall be designed in accordance with NFPA 55. In addition, the design shall meet the following requirements: (a) Hydrogen supply cylinders shall be located apart from safety-related systems in order to prevent damage from fire or explosion. (b) Where piping or tubing containing hydrogen is routed through fire compartments containing fire safe shutdown systems, piping or tubing shall be designed to retain pressure boundary integrity during and following a design basis earthquake.	CSA N293-07 : Clause 6.8.7.1* Systems containing hydrogen shall be designed in accordance with NFPA 55. In addition, the design shall meet the following requirements: (a) Hydrogen supply cylinders shall be located apart from safety-related systems in order to prevent damage from fire or explosion. (b) Where piping or tubing containing hydrogen is routed through fire compartments containing fire safe shutdown systems, piping or tubing shall be designed to retain pressure boundary integrity during and following a design basis earthquake.		Equivalent
6.8.6.2*	Systems that produce hydrogen or deuterium gas shall be designed to prevent the creation of an ignitable mixture. This can be achieved using venting, dilution, controlled combustion, or re-combination. The system shall be designed so that hydrogen control failure sets off an alarm in the main control room and initiates operator action.	CSA N293-07 : Clause 6.8.7.2* Systems that produce hydrogen or deuterium gas shall be designed to prevent the creation of an ignitable mixture. This can be achieved using venting, dilution, controlled combustion, or re-combination. The system shall be designed so that hydrogen control failure sets off an alarm in the main control room and initiates operator action.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.8.6.3*	In addition to the requirements of the NFCC, storage containers and piping for compressed gases shall not be located in the main control room complex and in other fire compartments with safety-related systems unless they are required for equipment or operation within that area. In this case, the design shall assess potential failures of the compressed gas components during a fire and shall ensure that the nuclear safety objectives of Clause 5.4.1 are met.	CSA N293-07 : Clause 6.8.7.3* In addition to the requirements of the NFCC, storage containers and piping for compressed gases shall not be located in the main control room complex and in other fire compartments with safety-related systems unless they are required for equipment or operation within that area. In this case, the design shall assess potential failures of the compressed gas components during a fire and shall ensure that the nuclear safety objectives of Clause 5.4.1 are met.		Equivalent
6.8.6.4	Facilities for aerosol storage shall be designed in accordance with the NFCC and NFPA 30B.	CSA N293-07 : Clause 6.8.7.4 Facilities for aerosol storage shall be designed in accordance with the NFCC and NFPA 30B.		Equivalent
6.8.7*	Bulk storage of dangerous goods shall be (a) located outdoors in detached storage buildings or cut-off rooms (see Clause 8.2.4 for additional handling requirements); (b) located to limit exposures that can impact nuclear safety; (c) separated from other buildings in accordance with the NFCC and NFPA 55; and (d) protected by fire separations or spatial separation from outdoor transformers, building egress paths, fire department vehicular access routes, ventilation intake openings, storage warehouses, buildings of combustible construction, water supplies for fire protection, isolation valves that control processes or fire protection systems, and sewage drains.	CSA N293-07 : Clause 6.8.8* Bulk storage of dangerous goods shall be (a) located outdoors in detached storage buildings or cut-off rooms (see Clause 8.2.3 for additional handling requirements); (b) located to limit exposures that can impact nuclear safety; (c) separated from other buildings in accordance with the NFCC and NFPA 55; and (d) protected by fire separations or spatial separation from outdoor transformers, building egress paths, fire department vehicular access routes, ventilation intake openings, storage warehouses, buildings of combustible construction, water supplies for fire protection, isolation valves that control processes or fire protection systems, and sewage drains		Equivalent
6.8.8	Radioactive waste storage rooms and rooms for the storage of radioactive materials shall be separated from the remainder of the building by a fire separation having a fire resistance rating of not less than 2 h.	CSA N293-07 : Clause 6.8.9 Radioactive waste storage rooms and rooms for the storage of radioactive materials shall be separated from the remainder of the building by a fire separation having a fire resistance rating of not less than 2 h.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
6.8.9		CSA N293-07 : Clause 6.8.10		Equivalent
6.8.9.1	Installed devices and process operations that, by design, pose an ignition fire hazard shall be eliminated or controlled to minimize the occurrence of fires.	CSA N293-07 : Clause 6.8.10.1 Installed devices and process operations that, by design, pose an ignition fire hazard shall be eliminated or controlled to minimize the occurrence of fires.		Equivalent
6.8.9.2	Electrical equipment and wiring shall be installed in accordance with the Canadian Electrical Code, Part I.	CSA N293-07 : Clause 6.8.10.2 Electrical equipment and wiring shall be installed in accordance with the Canadian Electrical Code, Part I.		Equivalent
6.8.9.3	All structures, including buildings, above-ground tanks, stacks, antennas, construction cranes, and meteorological towers, shall be protected by a lightning protection system in accordance with NFPA 780.	CSA N293-07 : Clause 6.8.10.3 All structures, including buildings, above-ground tanks, stacks, antennas, construction cranes, and meteorological towers shall be protected by a lightning protection system in accordance with NFPA 780.		Equivalent
6.8.9.4*	Potential external fires shall be identified and assessed and protection shall be provided to ensure that the nuclear safety criteria in Clause 5.4 are met. The impact on the plant and its occupants of fires from an external source shall be minimized by site selection, adequate spatial separation, or barriers.	CSA N293-07 : Clause 6.8.10.4* External fires shall be identified and assessed and protection shall be provided to ensure that the nuclear safety criteria in Clause 5.4 are met. The impact on the plant and its occupants of fires from an external source shall be minimized by site selection, adequate spatial separation, or barriers.		Equivalent
7		CSA N293-07 : Clause 7		Equivalent
7.1		CSA N293-07 : Clause 7.1		Equivalent
7.1.1	Clause 7 specifies requirements for the design, installation, and performance of fire alarm systems and fire suppression systems in accordance with the fire protection concepts outlined in Clause 5.	CSA N293-07 : Clause 7.1.1 Clause 7 specifies requirements for the design, installation, and performance of fire alarm systems and fire suppression systems in accordance with the fire protection objectives outlined in Clause 5.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.1.2	Equipment shall be tested by a nationally recognized fire test laboratory and marked to indicate current compliance with the applicable nationally recognized standard.	CSA N293-07 : Clause 7.1.2 Fire protection devices and equipment shall be listed and labelled by a certification organization accredited by the Standards Council of Canada.	While N293-07 Clause 7.1.2 requires that "Fire protection devices and equipment shall be listed and labelled by a certification organization accredited by the Standards Council of Canada", N293-12 Clause 7.1.2 requires that "Equipment shall be tested by a nationally recognized fire test laboratory and marked to indicate current compliance with the applicable nationally recognized standard" The two clauses are equivalent in intent.	Equivalent
7.2		CSA N293-07 : Clause 7.2		Equivalent
7.2.1*		CSA N293-07 : Clause 7.2.1*		Equivalent
7.2.1.1*	Fire alarm systems shall be designed, installed, and verified in accordance with (a) the NBCC; (b) CAN/ULC-S524; (c) CAN/ULC-S537; and (d) the additional requirements of this Standard. In the case of conflict between requirements, the most stringent requirements shall apply.	CSA N293-07 : Clause 7.2.1.1* Fire alarm systems shall be designed, installed, and verified in accordance with (a) the NBCC; (b) CAN/ULC-S524; (c) CAN/ULC-S537; and (d) the additional requirements of this Standard. In the case of conflict between requirements, the most stringent requirements shall apply. Fire alarm systems using very early warning fire detection technology shall be provided in accordance with the requirements of CAN/ULC-5524 and NFPA 76 (including Annex B of NFPA 76).	N293-07 Clause 7.2.1.1 is split into the the two N293-12 Clauses 7.2.1.1 and 7.2.1.2.	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.2.1.2*	In addition to the requirements in Clause 7.2.1.1, fire alarm systems using very early warning fire detection technology shall be designed, installed, and verified in accordance with the requirements of NFPA 76 (including Annex B).	CSA N293-07 : Clause 7.2.1.1* Fire alarm systems shall be designed, installed, and verified in accordance with (a) the NBCC; (b) CAN/ULC-S524; (c) CAN/ULC-S537; and (d) the additional requirements of this Standard. In the case of conflict between requirements, the most stringent requirements shall apply. Fire alarm systems using very early warning fire detection technology shall be provided in accordance with the requirements of CAN/ULC-5524 and NFPA 76 (including Annex B of NFPA 76).	N293-07 Clause 7.2.1.1 is split into the two N293-12 Clauses 7.2.1.1 and 7.2.1.2.	Equivalent
7.2.1.3*	In addition to the requirements of the NBCC for fire alarm and voice communication systems, fire alarm systems with integrated, supervised, one-way voice communication shall be provided in all structures and exterior areas within the protected area, as well as structures and areas external to the protected area where SSCs directly support the plant. The supervised one-way voice communication system shall provide main control room staff with a means to give one-way voice instruction to occupants during an emergency. Where intelligible voice communication is not possible (e.g., in locations remote from buildings), audible and visual signal devices and voice communication shall be provided at building entrances.	CSA N293-07 : Clause 7.2.1.2* In addition to the requirements of the NBCC for fire alarm and voice communication systems, fire alarm systems with integrated, supervised, one-way voice communication shall be provided in all structures and exterior areas within the protected area as well as structures and areas external to the protected area where SSCs directly support the plant. The supervised one-way voice communication system shall provide main control room staff with a means to give one-way voice instruction during an emergency to occupants. Where intelligible voice communication is not possible (e.g., in locations remote from buildings), audible and visual signal devices and voice communication shall be provided at building entrances		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.2.1.4*	Means shall be provided for intelligible two-way voice communication between emergency responders and the shift manager throughout the protected area and external areas under the scope of this Standard. Where redundant means of communication are provided, this two-way voice communication system shall not require electrical supervision.	CSA N293-07 : Clause 7.2.1.3* Means shall be provided for intelligible two-way voice communication between emergency responders and the shift manager throughout the protected area and external areas under the scope of this Standard. Where redundant means of communication are provided, this two-way voice communication system shall not require electrical supervision.		Equivalent
7.2.1.5*	The fire alarm system in buildings shall (a) be monitored by a display and control centre located in a central alarm and control facility (CACF) that includes the functions required by the NBCC; (b) meet the requirements of Clause 7.2.1.13 for the protection of electric cables; and (c) where data gathering panels are used, meet the requirements for large-scale networks outlined in CAN/ULC-S524.	CSA N293-07 : Clause 7.2.1.5* The fire alarm system in buildings shall (a) be monitored by a display and control centre located in a central alarm and control facility (CAC1 that includes the functions required by the NBCC; (b) meet the requirements of Clause 7.2.1.13 for the protection of electric cables; and (c) where data gathering panels are used, meet the requirements for large scale networks outlined in CAN/ULC-5524.		Equivalent
7.2.1.6		CSA N293-07 : Clause 7.2.1.6		Equivalent
7.2.1.6.1	Fire alarm systems shall provide two-stage operation, as follows: (a) first stage - an alert signal, as defined by the NBCC; and (b) second stage - an alarm signal, as defined by the NBCC.	CSA N293-07 : Clause 7.2.1.6.1 Fire alarm systems shall provide two-stage operation, as follows: (a) first stage — an alert signal, as defined by the NBCC; and (b) second stage — an alarm signal, as defined by the NBCC.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.2.1.6.2	The alert signal shall be directed to CACF staff and may remain silent throughout the balance of the building to suit the requirements of the plant's emergency notification procedures. On receipt of an alert signal, CACF staff shall have the capability to immediately provide a voice announcement over the fire alarm system, throughout the protected area and external areas under the scope of this Standard.	CSA N293-07 : Clause 7.2.1.6.2 The alert signal may be directed to CACF staff (in accordance with the NBCC) and remain silent throughout the balance of the building to suit the requirements of the plant's emergency notification procedures. On receipt of an alert signal, CACF staff shall have the capability to immediately provide a voice announcement over the fire alarm system, throughout the protected area and external areas under the scope of this Standard.		Equivalent
7.2.1.6.3	The alarm signal shall be activated automatically in the event that CACF staff do not acknowledge the signal within 5 min of initial fire alarm system activation. The alarm signal shall be supplemented by voice announcements. There shall be no delay in the ability to override the alarm signal and operate voice communication functions.	CSA N293-07 : Clause 7.2.1.6.3 The alarm signal shall be activated automatically in the event that CACF staff do not acknowledge the signal within 5 min of initial fire alarm system activation. The alarm signal shall be supplemented by voice announcements. There shall be no delay in the ability to override the alarm signal and operate voice communication functions.		Equivalent
7.2.1.6.4*	Buildings less than 500 m2 (5000 ft2) in building area may be provided with a single-stage fire alarm system.	CSA N293-07 : Clause 7.2.1.6.4 Buildings less than 500 m2 (5000 ft2) may be provided with a single-stage fire alarm system.		Equivalent
7.2.1.7	The fire alarm and voice communication systems shall be equipped with backup batteries capable of providing supervisory functions for not less than 24 h. Immediately following this 24 h period, emergency battery power under full load shall be available for not less than 2 h.	CSA N293-07 : Clause 7.2.1.7 The fire alarm and voice communication systems shall be equipped with backup batteries capable of providing supervisory functions for not less than 24 h. Immediately following this 24 h period, emergency battery power under full load shall be available for not less than 2 h.		Equivalent
7.2.1.8	The power supply for the fire alarm and voice communication systems shall be from a reliable and redundant power supply that is in compliance with CSA C282 or N290.5, and the NBCC requirements for building emergency power.	CSA N293-07 : Clause 7.2.1.8 The power supply for the fire alarm and voice communication systems shall be from a reliable and redundant power supply that is in compliance with CSA C282 or CAN/CSA-N290.5, and the NBCC requirements for building emergency power.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.2.1.9	The main control room (MCR) shall be considered the CACF.	CSA N293-07 : Clause 7.2.1.9 The main control room (MCR) shall be considered the CACF. The display and control centre shall be located inside the MCR. The display and control centre shall be a proprietary listed and labelled annunciator panel. The panel shall be capable of providing detailed information on the location and nature of the signal. In addition, the panel operator shall be able to control the fire alarm system without having to leave his or her station. Note: The panel operator need not be a licensed nuclear operator.		Equivalent
7.2.1.10		CSA N293-07 : Clause 7.2.1.10		Equivalent
7.2.1.10.1*	A display and control centre shall be located in the MCR and in each secondary control area (SCA) within the plant. The display and control centre shall be a proprietary panel that meets the requirements of Clause 7.1.2, capable of providing detailed information on the location and nature of the signal. In addition, the panel operator shall be able to control the fire alarm system without having to leave his or her station. Note: The panel operator need not be a licensed nuclear operator.	CSA N293-07 : Clause 7.2.1.9 The main control room (MCR) shall be considered the CACF. The display and control centre shall be located inside the MCR. The display and control centre shall be a proprietary listed and labelled annunciator panel. The panel shall be capable of providing detailed information on the location and nature of the signal. In addition, the panel operator shall be able to control the fire alarm system without having to leave his or her station. Note: The panel operator need not be a licensed nuclear operator. CSA N293-07 : Clause 7.2.1.10.1* A display and control centre shall be located in each secondary control area (SCA) within the plant.		Equivalent
7.2.1.10.2	Each display and control centre in an SCA shall, as a minimum, provide full display and control for all portions of the fire alarm system that are located within the area under the control of the SCA display and control centre.	CSA N293-07 : Clause 7.2.1.10.2 Each display and control centre in an SCA shall, at a minimum, provide full display and control for all portions of the fire alarm system that are located within the area under the control of the SCA display and control centre.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.2.1.10.3*	The fire alarm system shall be capable of transferring control from the MCR display and control centre to the SCA display and control centre. The transfer of control shall be initiated manually from the MCR and shall be incorporated into emergency operating procedures.	CSA N293-07 : Clause 7.2.1.10.3* The fire alarm system shall be capable of transferring control from the MCR display and control centre to the SCA display and control centre. The transfer of control shall be initiated manually from the MCR and shall be incorporated into emergency operating procedures.		Equivalent
7.2.1.11*	Two independent means of communication shall be provided to notify emergency response agencies, including off-site response agencies.	CSA N293-07 : Clause 7.2.1.11* Two independent means of communication shall be provided to notify emergency response agencies, including off-site response agencies.		Equivalent
7.2.1.12*		CSA N293-07 : Clause 7.2.1.12*		Equivalent
7.2.1.12.1	Automatic fire suppression systems that require fire detection and controls for actuation shall be equipped with hardware qualified in accordance with Clause 7.1.2 for use as an extinguishing-agent-releasing system. Releasing hardware, whether integrated in a fire alarm panel or in stand-alone panels, shall be installed and verified in accordance with the requirements for fire alarm systems in the NBCC and CAN/ULC-S524.	CSA N293-07 : Clause 7.2.1.12.1 Automatic fire suppression systems that require fire detection and controls for actuation shall be equipped with hardware listed for use as an extinguishing-agent-releasing system. Listed releasing hardware, whether integrated in a fire alarm panel or in stand-alone panels, shall be installed and verified in accordance with the requirements for fire alarm systems in the NBCC and CAN/ULC-S524.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.2.1.12.2*	Where separate extinguishing-agent-releasing panels or modules are integrated into the fire alarm panel, they shall (a) be connected to the building fire alarm system to provide system-wide visual annunciation of all fire, supervisory, and trouble signals that are annunciated on the releasing panel; (b) incorporate a common supervisory signal and a common trouble signal rather than using individual signals; (c) have a manual operation mode to discharge extinguishing agents; and (d) have a power supply, including an emergency power source, that meets the requirements for fire alarm systems in Clauses 7.2.1.7 and 7.2.1.8. Both the normal power supply and the emergency power source shall include power requirements for energized solenoid and alarm relays. In addition, each fire detection zone, individual panel, and individual module shall have its address annunciated on the building fire alarm system and shall be monitored.	CSA N293-07 : Clause 7.2.1.12.2* Where separate extinguishing-agent-releasing panels or modules are integrated into the fire alarm panel, they shall (a) be connected to the building fire alarm system to provide system-wide visual annunciation of all fire, supervisory, and trouble signals that are annunciated on the releasing panel; (b) incorporate a common supervisory signal and a common trouble signal rather than using individual signals; (c) have a manual operation mode to discharge extinguishing agents; and (d) have a power supply, including an emergency power source, that meets the requirements for fire alarm systems in Clauses 7.2.1.7 and 7.2.1.8. Both the normal power supply and the emergency power source shall include power requirements for energized solenoid and alarm relays. In addition, each fire detection zone, individual panel, and individual module shall have its address annunciated on the building fire alarm system and shall be monitored.		Equivalent
7.2.1.13		CSA N293-07 : Clause 7.2.1.13		Equivalent
7.2.1.13.1	Electrical conductors that are installed in service spaces containing other combustible materials and that are used in connection with fire alarm systems and emergency equipment, including fire alarm cables (e.g., fire-related smoke control equipment, pressurization equipment to limit smoke spread, equipment for the emergency operation of elevators, venting equipment to aid firefighting, the display and control centre fire-related equipment, and the voice communication system), shall be capable of performing their intended functions for not less than 1 h after the start of a fire.	CSA N293-07 : Clause 7.2.1.13.1 Electrical conductors that are installed in service spaces containing other combustible materials and that are used in connection with fire alarm systems and emergency equipment, including fire alarm cables (e.g., fire-related smoke control equipment, pressurization equipment to limit smoke spread, equipment for the emergency operation of elevators, venting equipment to aid firefighting, the display and control centre fire-related equipment, and the voice communication system), shall be capable of performing their intended functions for not less than 1 h after the start of a fire.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.2.1.13.2	Where the central alarm and control facility and the fire alarm control unit are in different fire compartments, the electrical conductors connecting the central alarm and control facility to the fire alarm control unit shall be protected against fire exposure to ensure continued operation for not less than 1 h after the start of a fire.	CSA N293-07 : Clause 7.2.1.13.2 Where the central alarm and control facility and the fire alarm control unit are in different fire compartments, the electrical conductors connecting the central alarm and control facility to the fire alarm control unit shall be protected against fire exposure to ensure continued operation for not less than 1 h after the start of a fire		Equivalent
7.2.2		CSA N293-07 : Clause 7.2.2		Equivalent
7.2.2.1	Manual pull stations shall be located at all exits required by the NBCC. In addition, where the NBCC 60 m (200 ft) exit rule is used (see the NBCC, Division B, Sentence 3.4.2.5(2)), manual pull stations shall be located along each main aisle so that the maximum travel distance within the aisle to a manual pull station is not more than 30 m (100 ft) in areas without sprinklers and not more than 45 m (150 ft) in areas with sprinklers. Note: The term “aisle” refers to corridors, hallways, pathways, or any other means of egress.	CSA N293-07 : Clause 7.2.2.1 Manual pull stations shall be located at all exits required by the NBCC. In addition, where the NBCC 60 m (200 ft) exit rule is used (see the NBCC, Division B, Sentence 3.4.2.5(2)), manual pull stations shall be located along each main aisle so that the maximum travel distance within the aisle to a manual pull station is not more than 30 m (100 ft) in areas without sprinklers and not more than 45 m (150 ft) in areas with sprinklers. Note: The term "aisle" refers to corridors, hallways, pathways, or any other means of egress.		Equivalent
7.2.2.2*	Where fire detection is required as specified in Clause 6.3.3.3, Item (c), a fire alarm system providing an equivalent level of performance to very early warning detection technology shall be provided.	CSA N293-07 : Clause 7.2.2.2* Where fire detection is required as specified in Clause 6.3.3.3, Item (c), a fire alarm system using very early warning detection technology shall be provided.	While N293-07 Clause 7.2.2.2 refers to use of a fire alarm system using very early warning detection technology, N293-12 Clause 7.2.2.2 more generally refers to use of a fire alarm system providing an equivalent level of performance to early warning detection technology. The two clauses are equivalent in intent.	Equivalent
7.2.2.3*	The control room complex shall be equipped with a fire alarm system that uses very early warning fire detection technology. Compensatory measures shall be provided when the system is out of service.	CSA N293-07 : Clause 7.2.2.3* The control room complex shall be equipped with a fire alarm system that uses very early warning fire detection technology. Compensatory measures shall be provided when the system is out of service.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.2.2.4*	Alternate fire detection methods shall be considered where fire detectors required by this Standard cannot operate in accordance with their design specifications or where the detection method is not practical for reasons such as high radiation levels or excessive heights. The technical justification for the alternate measure shall be documented in the plant's code compliance review and cross-referenced or otherwise noted in the plant's FPA.	CSA N293-07 : Clause 7.2.2.4* Alternate fire detection methods shall be considered where fire detectors required by this Standard cannot operate in accordance with their design specifications or where the detection method is not practical for reasons such as high radiation levels or excessive heights. The technical justification for the alternate measure shall be documented in the plant's code compliance review and cross-referenced or otherwise noted in the plant's FHA.	The N293-07 Clause 7.2.2.4 reference to the FHA is more generally replaced by the N293-12 Clause 7.2.2.4 reference to the FPA.	Equivalent
7.2.3		CSA N293-07 : Clause 7.2.3		Equivalent
7.2.3.1	Accessible spaces, with the exception of the main and secondary control rooms, shall be equipped with audible and/or visual fire alarm signal devices.	CSA N293-07 : Clause 7.2.3.1 Accessible spaces, with the exception of the main and secondary control rooms, shall be equipped with audible and/or visual fire alarm signal devices.		Equivalent
7.2.3.2	Fire alarm signals and voice announcements shall be audible and intelligible in interior areas, in accordance with the NBCC and CAN/ULC-S524. Fire and voice signals shall be distinctive and shall not be capable of being confused with other alarm signals.	CSA N293-07 : Clause 7.2.3.2 Fire alarm signals and voice announcements shall be audible and intelligible in interior areas, in accordance with the NBCC and CAN/ULC-5524. Fire and voice signals shall be distinctive and shall not be capable of being confused with other alarm signals.		Equivalent
7.2.3.3*	Where visual signals are provided, both visual and audible signals shall operate immediately and simultaneously upon activation of a fire alarm signal. Operators within the main control room shall be capable of selectively discontinuing alarm signals. Visual signals shall meet the requirements of NFPA 72 for synchronization and minimum candela.	CSA N293-07 : Clause 7.2.3.3* Where visual signals are provided, both visual and audible signals shall operate immediately and simultaneously upon activation of a fire alarm signal. Operators within the main control room shall be capable of selectively discontinuing alarm signals. Visual signals shall meet the requirements of NFPA 72 for synchronization and minimum candela.		Equivalent
7.2.3.4		CSA N293-07 : Clause 7.2.3.4		Equivalent
7.2.3.4.1	Telephone handsets for local paging announcements may interface with the voice communication system.	CSA N293-07 : Clause 7.2.3.4.1 Telephone handsets for local paging announcements may interface with the voice communication system.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.2.3.4.2	Where the interface in Clause 7.2.3.4.1 is provided, it shall be compatible with the voice communication system and shall not impair the operation of the fire alarm system.	CSA N293-07 : Clause 7.2.3.4.2 Where the interface in Clause 7.2.3.4.1 is provided, it shall be compatible with the voice communication system and shall not impair the operation of the fire alarm system.		Equivalent
7.2.3.4.3	The telephone handset interface shall be disabled during a fire alarm signal condition, except for handsets located within the MCR.	CSA N293-07 : Clause 7.2.3.4.3 The telephone handset interface shall be disabled during a fire alarm signal condition, except for handsets located within the MCR.		Equivalent
7.3		CSA N293-07 : Clause 7.3		Equivalent
7.3.1		CSA N293-07 : Clause 7.3.1		Equivalent
7.3.1.1		CSA N293-07 : Clause 7.3.1.1		Equivalent
7.3.1.1.1	The selection of a fire suppression system shall, as a minimum, take into consideration the system's effectiveness in relation to (a) the design basis fire; (b) performance levels; (c) reliability; and (d) potential damage resulting from the fire suppression agent.	CSA N293-07 : Clause 7.3.1.1.1 The selection of a fire suppression system shall, as a minimum, take into consideration the system's effectiveness in relation to (a) the design basis fire; (b) performance levels; (c) reliability; and (d) potential damage resulting from the fire suppression agent.		Equivalent
7.3.1.1.2	Fire suppression protection, where required by this Standard, shall be provided in accordance with (a) this Standard and in particular with Clause 7.1.2; (b) the NBCC; (c) the NFCC; and (d) additional applicable technical requirements specified in the documents listed in Clause 7.3.1.1.3.	CSA N293-07 : Clause 7.3.1.1.2 Fire suppression protection, where required by this Standard, shall be provided in accordance with (a) this Standard; (b) the NBCC; (c) the NFCC; and (d) additional applicable technical requirements specified in the documents listed in Clauses 7.3.1.1.3 and 7.3.1.1.4.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.3.1.1.3*	Design of systems shall comply with the requirements of the AHJ for pressure-retaining components and shall be in accordance with the following, as applicable: (a) NFPA 10; (b) NFPA 11; (c) NFPA 12; (d) NFPA 12A; (e) NFPA 13; (f) NFPA 14; (g) NFPA 15; (h) NFPA 16; (i) NFPA 17; (j) NFPA 17A; (k) NFPA 20; (l) NFPA 22; (m) NFPA 24; (n) NFPA 25; (o) NFPA 750; (p) NFPA 2001; and (q) FM 7-101.	CSA N293-07 : Clause 7.3.1.1.3* Design of systems shall comply with the requirements of the AHJ for pressure-retaining components and shall be in accordance with the following, as applicable: (a) NFPA 10; (b) NFPA 11; (c) NFPA 12; (d) NFPA 12A; (e) NFPA 13; (f) NFPA 14; (g) NFPA 15; (h) NFPA 16; (i) NFPA 17; (j) NFPA 17A; (k) NFPA 20; (l) NFPA 22; (m) NFPA 24; (n) NFPA 25; (o) NFPA 750; (p) NFPA 2001; and (q) FM 7-101.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.3.1.2*	The automatic fire suppression required by Clause 5.7.4.2.1 shall be provided using automatic sprinkler systems. Where automatic fire suppression systems are not provided, the FPA shall demonstrate that adequate manual fire suppression or passive fire mitigation is provided and that all the fire protection goals are met. Special extinguishing systems may be used in place of automatic sprinkler systems where it can be demonstrated that they provide (a) an adequate level of fire protection for the specific hazard; and (b) an acceptable level of reliability.	CSA N293-07 : Clause 7.3.1.2* The automatic fire suppression required by Clause 5.7.4.2.1 shall be provided using automatic sprinkler systems. Where automatic fire suppression systems are not provided, the FHA or another assessment shall demonstrate that adequate manual fire suppression or passive fire mitigation is provided and that all the fire protection goals are met. Special extinguishing systems may be used in place of automatic sprinkler systems where it can be demonstrated that they provide (a) an adequate level of fire protection for the specific hazard; and (b) an acceptable level of reliability	The N293-07 Clause 7.3.1.2 reference to the FHA is more generally replaced by the N293-12 Clause 7.3.1.2 reference to the FPA.	Equivalent
7.3.1.3	The design of automatic fire suppression systems shall include means to mitigate hazards created by the operation of the suppression system. These hazards include (a) the noise of suppression system discharge; (b) the loss of visibility due to suppression system discharge; (c) asphyxiation hazards created by suppression system discharge; (d) dispersion of the extinguishing agent; (e) flooding; (f) additional loads on structures; (g) shorting of electrical circuits; (h) cooling effects; (i) pressurization; (j) residues and deposits; (k) corrosive products; (l) life safety considerations for plant operators and firefighters (e.g., electric shocks, toxic gases); and	CSA N293-07 : Clause 7.3.1.3 The design of automatic fire suppression systems shall include means to mitigate hazards created by the operation of the suppression system. These hazards include (a) the noise of suppression system discharge; (b) the loss of visibility due to suppression system discharge; (c) asphyxiation hazards created by suppression system discharge; (d) dispersion of the extinguishing agent; (e) flooding; (f) additional loads on structures; (g) shorting of electrical circuits; (h) cooling effects; (i) pressurization; (j) residues and deposits; (k) corrosive products; (l) life safety considerations for plant operators and		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
	(m) discharge of liquids and gases into the environment.	firefighters (e.g., electric shocks, toxic gases); and (m) discharge of liquids and gases into the environment.		
7.3.1.4		CSA N293-07 : Clause 7.3.1.4*		Equivalent
7.3.1.4.1	In order to achieve the required level of fire safety, fire suppression systems shall be designed and installed in accordance with the applicable documents listed in Clause 7.3.1.1.3.	CSA N293-07 : Clause 7.3.1.4.1 In order to achieve the required level of fire safety, fire suppression systems shall be designed and installed in accordance with the applicable documents listed in Clause 7.3.1.1.3.		Equivalent
7.3.1.4.2*	In order to meet the structural integrity and material quality control requirements to ensure adequate provisions are made for component support and pressure boundary integrity, fire suppression systems shall be designed, installed, and registered in accordance with the pressure-retaining component requirements of the AHJ. The performance requirements and functional attributes mandated by this Standard shall be maintained.	CSA N293-07 : Clause 7.3.1.4.2 In order to meet the structural integrity and material quality control requirements to ensure adequate provisions are made for component support and pressure boundary integrity, fire suppression systems shall be designed, installed, and registered in accordance with the pressure-retaining component requirements of the AHJ. The performance requirements and functional attributes mandated by this Standard shall be maintained.		Equivalent
7.3.2		CSA N293-07 : Clause 7.3.2		Equivalent
7.3.2.1*		CSA N293-07 : Clause 7.3.2.1*		Equivalent
7.3.2.1.1*	Sources of water shall meet the following requirements: (a) Water for fire protection shall be stored in reservoirs or tanks, or taken from a large natural body of fresh water (i.e., a lake or river). (b) Only fresh water shall be used as the primary source of supply. Sea water may be used only as a backup water supply. (c) Municipal water supplies shall not be the primary source of water for fire protection. However, they may be used to supply make-up water to the reservoir or tank.	CSA N293-07 : Clause 7.3.2.1.1* Sources of water shall meet the following requirements: (a) water for fire protection shall be stored in reservoirs or tanks, or taken from a large natural body of fresh water (i.e., a lake or river); (b) only fresh water shall be used as the primary source of supply. Sea water may be used only as a backup water supply; and (c) municipal water supplies shall not be the primary source of water for fire protection. However, they may be used to supply make-up water to the reservoir or tank.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.3.2.1.2*	The fire protection water supply volume shall be calculated based on the largest expected flow rate for a period of 2 h. The expected flow rate shall be based on the largest concurrent design demand of any automatic water-based suppression system designed in accordance with this Standard, taking into account the corresponding allowance for manual hose streams (including standpipe demands). The hose stream demand shall include the calculated demand for large hoses (88.9 mm [3.5 in] and larger) where required by pre-fire plans described in Clause 10.3 and a minimum attack hose demand of 2850 L/min (750 US gpm). The fire protection water supply shall be capable of delivering this design demand in the event that the hydraulically most favourable portion of the fire main loop is out of service.	CSA N293-07 : Clause 7.3.2.1.2* The fire protection water supply volume shall be calculated based on the largest expected flow rate for a period of 2 h. The expected flow rate shall be based on the largest concurrent design demand of any automatic water-based suppression system designed in accordance with this Standard, taking into account the corresponding allowance for manual hose streams (including standpipe demands). The hose stream demand shall include the calculated demand for large hoses (88.9 mm [3.5 in] and larger) and a minimum attack hose demand of 2850 L/min (750 US gpm). The fire protection water supply shall be capable of delivering this design demand in the event that the hydraulically most favourable portion of the fire main loop is out of service.		Equivalent
7.3.2.1.3	Where reservoirs or tanks are used, two separate reservoirs or tanks, each having 100% of the supply volume required in Clause 7.3.2.1.2, shall be provided.	CSA N293-07 : Clause 7.3.2.1.3 Where reservoirs or tanks are used, two separate reservoirs or tanks, each having 100% of the supply volume required in Clause 7.3.2.1.2, shall be provided.		Equivalent
7.3.2.1.4	Reservoirs or tanks shall be designed in accordance with NFPA 22 and interconnected such that fire pumps can take suction from one or both. A failure in one reservoir or tank or its piping shall not cause both reservoirs or tanks to drain.	CSA N293-07 : Clause 7.3.2.1.4 Reservoirs or tanks shall be designed in accordance with NFPA 22 and interconnected such that fire pumps can take suction from one or both. A failure in one reservoir or tank or its piping shall not cause both reservoirs or tanks to drain.		Equivalent
7.3.2.1.5*	The ability to draft water from the supply source with fire trucks and inject it into the fire protection water supply system shall be provided. The design drafting capacity shall be the capacity required by the FPA but not less than 7600 L/min (2000 US gpm).	CSA N293-07 : Clause 7.3.2.1.5* The ability to draft water from the supply source with fire trucks and inject it into the fire protection water supply system shall be provided. The design drafting capacity shall be greater than or equal to 7600 L/min (2000 US gpm).		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.3.2.1.6*	The fire protection water supply may be used on an emergency basis to provide backup to nuclear safety-related systems, as long as the fire protection water supply systems are designed to deliver the combined fire and nuclear safety flow demands for the duration specified by the applicable design.	CSA N293-07 : Clause 7.3.2.1.6* The fire protection water supply may be used on an emergency basis to provide backup to nuclear safety systems, as long as the fire protection water supply systems are designed to deliver the combined fire and nuclear safety flow demands for the duration specified by the applicable design	N293-07 Clause 7.3.2.1.6 speaks to providing backup to nuclear safety systems, while N293-12 Clause 7.3.2.1.6 more generally speaks to providing backup to nuclear safety-related systems. The intent is the same for both clauses.	Equivalent
7.3.2.2*	Fire pumps shall be provided in accordance with this Standard and NFPA 20. In addition, the following requirements shall apply: (a) As a minimum, the fire protection water pumping system design shall be capable of providing 120% of the total required flow rate at the design pressure, assuming failure of the largest pump. (b) Fire pumps shall have automatic start and manual shut-off capabilities. (c) The water supply system for fire protection shall be provided with an automatic pressure maintenance method (e.g., jockey pumps) independent of the fire pumps. (d) As a minimum, the fire protection water pumping system shall consist of at least one diesel-engine-driven fire pump set and one electric-motor-driven fire pump set, with each pump set being capable of providing, the flow rate and pressure specified in Item (a). (e) The fire pump arrangement shall be designed to prevent common cause failure. (f) To prevent common cause failure due to fire, each diesel-driven fire pump, including its engine driver, controls, and day tank, shall be separated from the remaining fire pumps and from the plant by fire separation with a minimum rating of 3 h. (g) Diesel fuel for fire pumps shall be separated so that the fuel is not a fire hazard to safety-related SSCs. (h)	CSA N293-07 : Clause 7.3.2.2* Fire pumps shall be provided in accordance with this Standard and NFPA 20. In addition, the following requirements shall apply: (a) At a minimum, the fire protection water pumping system design shall be capable of providing 120% of the total required flow rate at the design pressure, assuming failure of the largest pump. (b) Fire pumps shall have automatic start and manual shut-off capabilities. (c) The water supply system for fire protection shall be provided with an automatic pressure maintenance method (e.g., jockey pumps) independent of the fire pumps. (d) At a minimum, the fire protection water pumping system shall consist of at least one diesel-engine-driven fire pump and one electric-motor-driven fire pump, with each being capable of providing the flow rate and pressure specified in Item (a). (e) The fire pump arrangement shall be designed to prevent common cause failure. (f) To prevent common cause failure due to fire, each diesel-driven fire pump, including its engine driver, controls, and day tank, shall be separated from the remaining fire pumps and from the plant by fire separation with a minimum rating of 3 h. (g) Diesel fuel for fire pumps shall be separated so that		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
	Each fire pump shall be individually connected to the yard fire main. (i) The following operational elements of fire pumps shall have individual indicators in the CACF: (i) low water level in reservoir or tanks; (ii) power failure to fire pump motor or fire pump engine controllers; (iii) running of fire pump; (iv) fire pump trouble; (v) low temperature in the fire pump room and reservoirs or tanks; (vi) abnormal position of isolation valves; and (vii) miscellaneous supervisory signal for other trouble indicators that can be important, such as abnormally high or low water pressures or failure of compressed air source.	the fuel is not a fire hazard to safety-related equipment. (h) Each fire pump shall be individually connected to the yard fire main. (i) The following operational elements of fire pumps shall have individual indicators in the CACF: (i) low water level in reservoir or tanks; (ii) power failure to fire pump motor or fire pump engine controllers; (iii) running of fire pump; (iv) fire pump trouble; (v) low temperature in the fire pump room and reservoirs or tanks; (vi) abnormal position of isolation valves; and (vii) miscellaneous supervisory signal for other trouble indicators that can be important, such as abnormally high or low water pressures or failure of compressed air source.		

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.3.2.3*	The fire protection water distribution system shall be provided in accordance with NFPA 24. In addition, the following requirements shall apply: (a) Distribution of water to fire protection systems shall be through a loop main such that water can reach each building connection from two independent directions. Water mains shall not be buried under buildings. (b) At least two independent connections to the loop main shall be provided for each major building such that each connection is capable of providing the maximum water flow to meet demand and pressure requirements. (c) Means for inspection and flushing of the piping systems shall be provided. (d) Approved visually indicating sectional control valves (e.g., post-indicator valves) shall be provided such that portions of the main can be isolated for maintenance or repair without impairing the fire protection water supply to each major building. (e) Building fire water supply entry points, sprinkler control equipment, standpipe control equipment, and feed mains and bulk mains to water-based suppression systems that are used to satisfy the requirements of Item (b) may be located within buildings in order to supply sprinkler and standpipe systems. (f) Building fire water supply entry points, sprinkler control equipment, standpipe control equipment, and feed mains and bulk mains to water-based suppression systems shall be located in an area that has sprinkler protection, unless the FPA determines that the hazard present is insufficient to challenge the integrity of the piping and supports.	CSA N293-07 : Clause 7.3.2.3* The fire protection water distribution system shall be provided in accordance with NFPA 24. In addition, the following requirements shall apply: (a) Distribution of water to fire protection systems shall be through a loop main such that water can reach each building connection from two independent directions. Water mains shall not be buried under buildings. (b) At least two independent connections to the loop main shall be provided for each major building such that each connection is capable of providing the maximum water flow to meet demand and pressure requirements. (c) Means for inspection and flushing of the piping systems shall be provided. (d) Approved visually indicating sectional control valves (e.g., post-indicator valves) shall be provided such that portions of the main can be isolated for maintenance or repair without impairing the fire protection water supply to each major building. (e) Building fire water supply entry points, sprinkler control equipment, standpipe control equipment, and feed mains and bulk mains to water-based suppression systems that are used to satisfy the requirements of Item (b) may be located within buildings in order to supply sprinkler and standpipe systems. (f) Building fire water supply entry points, sprinkler control equipment, standpipe control equipment, and feed mains and bulk mains to water-based suppression systems shall be located in an area that has sprinkler protection, unless the FHA determines that the hazard present is insufficient to challenge the integrity of the piping and supports.	The N293-07 Clause 7.3.2.3 reference to the FHA determination of hazard is more generally replaced by the N293-12 Clause 7.3.2.3 reference to the FPA.	Equivalent
7.3.3		CSA N293-07 : Clause 7.3.3		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.3.3.1*	Where an automatic sprinkler system is required, the design and installation shall be in accordance with NFPA 13 and NFPA 15. The NFPA requirements may be modified in accordance with the requirements of this Standard in order to meet the performance objectives of the system.	CSA N293-07 : Clause 7.3.3.1* Where an automatic sprinkler system is required, the design and installation shall be in accordance with NFPA 13 and NFPA 15. The NFPA requirements may be modified in accordance with the requirements of this Standard in order to meet the performance objectives of the system.		Equivalent
7.3.3.2	Where multiple automatic sprinkler systems are provided within a common area and can reasonably be expected to operate simultaneously during a fire, the concurrent demand of the automatic sprinkler systems, taking into account hose stream allowance, shall be added to establish the total water demand.	CSA N293-07 : Clause 7.3.3.2 Where multiple automatic sprinkler systems are provided within a common area and can reasonably be expected to operate simultaneously during a fire, the concurrent demand of the automatic sprinkler systems, taking into account hose stream allowance, shall be added to establish the total water demand		Equivalent
7.3.3.3	Where main structural steel columns are protected with sidewall sprinklers instead of fireproofing, sidewall sprinklers shall be arranged so that (a) The vertical distance between sprinklers does not exceed 3 m (10 ft). (b) The highest sidewall sprinkler shall be located within 0.3 m (12 in) of the bottom of the ceiling beams. (c) The sprinklers are placed in an alternating pattern on opposing sides of the column. (d) The sprinklers discharge on the web. Obstructions on the web shall be considered when arranging sidewall sprinklers.	CSA N293-07 : Clause 7.3.3.3 Where main structural steel columns are protected with sidewall sprinklers instead of fireproofing, sidewall sprinklers shall be arranged so that (a) the vertical distance between sprinklers does not exceed 3 m (10 ft); (b) the highest sidewall sprinkler shall be located within 0.3 m (12 in) of the bottom of the ceiling beams; (c) the sprinklers are placed in an alternating pattern on opposing sides of the column; and (d) the sprinklers discharge on the web. Obstructions on the web shall be considered when arranging sidewall sprinklers.		Equivalent
7.3.3.4*	Cable trays shall be located a minimum of 0.45 m (18 in) below automatic sprinkler deflectors located at ceiling level. Automatic sprinklers shall be arranged such that sprinkler discharge will provide effective fire suppression where cable trays are stacked.	CSA N293-07 : Clause 7.3.3.4* Cable trays shall be located a minimum of 0.45 m (18 in) below automatic sprinkler deflectors located at ceiling level. Automatic sprinklers shall be arranged such that sprinkler discharge will provide effective fire suppression where cable trays are stacked.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.3.3.5*	Where automatic sprinkler protection is provided, and where sprinklers are installed below cable trays, they shall be a maximum of 0.15 m (6 in) below the bottom of the cable tray. A passive heat barrier shall be provided that protects the cables and remains in place until the sprinklers have been activated.	CSA N293-07 : Clause 7.3.3.5* Where automatic sprinkler protection is provided, and where sprinklers are installed below cable trays, they shall be a maximum of 0.15 m (6 in) below the bottom of the cable tray.	N293-12 Clause 7.3.3.5 has the additional requirement "A passive heat barrier shall be provided that protects the cables and remains in place until the sprinklers have been activated." This requirement is taken from N293-07 Appendix A Clause A.7.3.3.5. Therefore, the intent remains the same.	Equivalent
7.3.3.6*	Diking, drainage, a combination of both, or other means of containment shall be provided to limit the spread of flammable and combustible liquids (including firefighting water contaminated with flammable and combustible liquids) and to divert liquid from equipment that, when damaged by water, becomes inoperable and affects nuclear safety. Individual dike areas shall not exceed 25% of the sprinkler design area, except where the size of the fire compartment is less than 1000 m2 (10 000 ft2). Diking or the diking/drainage combination shall contain and/or control the volume of liquid and firefighting water within the sprinkler design area based on a 30 min discharge.	CSA N293-07 : Clause 7.3.3.6* Diking, drainage, a combination of both, or other means of containment shall be provided to limit the spread of flammable and combustible liquids (including firefighting water contaminated with flammable and combustible liquids) and to divert liquid from equipment that, when damaged by water, becomes inoperable and affects nuclear safety. Individual dike areas shall not exceed 25% of the sprinkler design area, except where the size of the fire compartment is less than 1000 m2 (10 000 ft2). Diking or the diking/drainage combination shall contain and/or control the volume of liquid and firefighting water within the sprinkler design area based on a 30 min discharge.		Equivalent
7.3.3.7*	Oil-filled transformers, including their adjacent non-absorbing ground areas, shall be protected with an automatic water-based spray system, in accordance with NFPA 15 or NFPA 16.	CSA N293-07 : Clause 7.3.3.7* Oil-filled transformers, including their adjacent non-absorbing ground areas, shall be protected with an automatic water-based spray system, in accordance with NFPA 15 or NFPA 16.		Equivalent
7.3.4		CSA N293-07 : Clause 7.3.4		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.3.4.1*	Where an automatic sprinkler system is required, and where it is demonstrated in the FPA that an automatic sprinkler system can create an unacceptable hazard, special extinguishing systems may be used. Special extinguishing systems include (a) water mist systems; (b) clean agent extinguishing systems; (c) carbon dioxide extinguishing systems; (d) foam extinguishing systems; (e) water spray extinguishing systems; (f) foam-water sprinkler systems and foam-water spray extinguishing systems; and (g) dry and wet chemical extinguishing systems.	CSA N293-07 : Clause 7.3.4.1 Where an automatic sprinkler system is required, and where it is demonstrated in the FHA that an automatic sprinkler system can create an unacceptable hazard, special extinguishing systems may be used. Special extinguishing systems include (a) water mist systems; (b) clean agent extinguishing systems; (c) carbon dioxide extinguishing systems; (d) foam extinguishing systems; (e) water spray extinguishing systems; (f) foam-water sprinkler systems and foam-water spray extinguishing systems; and (g) dry and wet chemical extinguishing systems.	The N293-07 Clause 7.3.4 reference to the FHA demonstration of unacceptable hazard is more generally replaced by the N293-12 Clause 7.3.4 reference to the FPA.	Equivalent
7.3.4.2	Where special extinguishing systems are used, they shall be designed, installed, maintained, and inspected in accordance with applicable NFPA Standards.	CSA N293-07 : Clause 7.3.4.2 Where special extinguishing systems are used, they shall be designed, installed, maintained, and inspected in accordance with applicable NFPA Standards.		Equivalent
7.3.5*		CSA N293-07 : Clause 7.3.5*		Equivalent
7.3.5.1	All areas of the plant shall be protected by portable fire extinguishers, in accordance with the NFCC and NFPA 10.	CSA N293-07 : Clause 7.3.5.1 All areas of the plant shall be protected by portable fire extinguishers, in accordance with the NFCC and NFPA 10.		Equivalent
7.3.5.2*	Extinguishers may be located outside of a fire zone due to radiological conditions or because the area is normally inaccessible.	CSA N293-07 : Clause 7.3.5.2 Extinguishers may be located outside of a fire zone due to radiological conditions or because the area is normally inaccessible.		Equivalent
7.3.6		CSA N293-07 : Clause 7.3.6		Equivalent
7.3.6.1	Outdoor areas shall be provided with fire hydrants, in accordance with NFPA 24.	CSA N293-07 : Clause 7.3.6.1 Outdoor areas shall be provided with fire hydrants, in accordance with NFPA 24.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.3.6.2*	Fire hydrants shall be spaced a maximum of 75 m (250 ft) apart and shall be located not less than 12.2 m (40 ft) from the buildings to be protected.	CSA N293-07 : Clause 7.3.6.2* Fire hydrants shall be spaced a maximum of 75 m (250 ft) apart and shall be located not less than 12.2 m (40 ft) from the buildings to be protected.		Equivalent
7.3.6.3*	Fire hydrants shall have one pumper outlet and two hose outlets. Fire hydrants shall have one pumper connection with a diameter of 89 mm (3.5 in) or larger and shall have two hose outlets each having a diameter of 64 mm (2.5 in).	CSA N293-07 : Clause 7.3.6.3* Fire hydrants shall have one pumper outlet and two hose outlets. Fire hydrants shall have one pumper connection with a diameter of 89 mm (3.5 in) or larger and shall have two hose outlets each having a diameter of 64 mm (2.5 in).		Equivalent
7.3.6.4	Isolation valves that control only water supplies to a fire hydrant shall be post-indicating valves and may be locked open in lieu of fire alarm supervision.	CSA N293-07 : Clause 7.3.6.4 Isolation valves that control only water supplies to a fire hydrant shall be post-indicating valves and may be locked open in lieu of fire alarm supervision.		Equivalent
7.3.6.5	Wall hydrants shall not be a substitute for yard hydrants.	CSA N293-07 : Clause 7.3.6.5 Wall hydrants shall not be a substitute for yard hydrants		Equivalent
7.3.6.6	Fire hydrants shall be marked in accordance with NFPA 291.	CSA N293-07 : Clause 7.3.6.6 Fire hydrants shall be marked in accordance with NFPA 291.		Equivalent
7.3.7*	Standpipes shall be provided in accordance with NFPA 14. In addition, the following requirements shall apply: (a) A minimum of 2850 L/min (750 US gpm) shall be included for manual hose stream demand for all automatic fire suppression system designs. (b) Areas inside the containment structure shall be provided with Class I (as defined in NFPA 14) standpipe systems. A dry connection through the containment structure may be manually connected to the standpipe. (c) The minimum pressure available at the Class I hose valve shall be 690 kPa (100 psig) at a flow rate of 950 L/min (250 US gpm).	CSA N293-07 : Clause 7.3.7* Standpipes shall be provided in accordance with NFPA 14. In addition, the following requirements shall apply: (a) A minimum of 2850 L/min (750 US gpm) shall be included for manual hose stream demand for all automatic fire suppression system designs. (b) Areas inside the containment structure shall be provided with Class I (as defined in NFPA 14) standpipe systems. A dry connection through the containment structure may be manually connected to the standpipe. (c) The minimum pressure available at the Class I hose valve shall be 690 kPa (100 psig) at a flow rate of 950 L/min (250 US gpm).		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.3.8		CSA N293-07 : Clause 7.3.8		Equivalent
7.3.8.1	Means for manual firefighting shall be provided in accordance with the NBCC and/or the FPA.	CSA N293-07 : Clause 7.3.8.1 Means for manual firefighting shall be provided in accordance with the NBCC and/or the FHA	The N293-07 Clause 7.3.8.1 reference to the FHA is more generally replaced by the N293-12 Clause 7.3.8.1 reference to the FPA.	Equivalent
7.3.8.2*	Where manual firefighting is credited as a means of fire suppression in the FPA, access for firefighting shall be provided. The access shall be adequate in size for a firefighter dressed in full fire-protective clothing, including a self-contained breathing apparatus (SCBA).	CSA N293-07 : Clause 7.3.8.2* Where manual firefighting is credited as a means of fire suppression in the FHA, access for firefighting shall be provided. The access shall be adequate in size for a firefighter dressed in full fire-protective clothing, including a self-contained breathing apparatus (SCBA).	The N293-07 Clause 7.3.8.2 reference to the FHA is more generally replaced by the N293-12 Clause 7.3.8.2 reference to the FPA.	Equivalent
7.4		CSA N293-07 : Clause 7.4		Equivalent
7.4.1	All fire protection systems shall be seismically designed to satisfy the requirements of NFPA 13 and NBCC, except for fire protection systems specified in Clauses 7.4.2 and 7.4.3. The design and installation of fire protection systems specified in Clause 7.4.2 and 7.4.3 shall comply with CSA N289.3. The following seismic categories shall be used to identify the extent to which SSCs are required to remain operational after an earthquake: (a) Seismic Category A - SSCs that must retain their pressure boundary integrity, structural integrity, or passive function (i.e., equipment that does not have an active mechanical function but might have an electrical or load-bearing function) during and following an earthquake. (b) Seismic Category B - SSCs that must retain their pressure boundary integrity, structural integrity, or active function and in addition must remain operable during and following an earthquake. Category B includes equipment that is not part of the pressure boundary but must operate during and following an earthquake.	CSA N293-07 : Clause 7.4.1 The design and installation of fire protection systems specified in Clause 7.4.2 and 7.4.3 shall comply with CSA N289.3. The following seismic categories shall be used to identify the extent to which SSCs are required to remain operational after an earthquake: (a) Seismic Category A — SSCs that must retain their pressure boundary integrity, structural integrity, or passive function (i.e., equipment that does not have an active mechanical function but might have an electrical or load-bearing function) during and following an earthquake. (b) Seismic Category B — SSCs that must retain their pressure boundary integrity, structural integrity, or active function and in addition must remain operable during and following an earthquake. Category B includes equipment that is not part of the pressure boundary but must operate during and following an earthquake.	Additional requirement in CSA N293-12 Clause 7.4.1: All fire protection systems shall be seismically designed to satisfy the requirements of NFPA 13 and NBCC, except for fire protection systems specified in Clauses 7.4.2 and 7.4.3.	Different

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
7.4.2	Automatic fire suppression systems and all other fire protection equipment shall be seismically qualified to Category A for the following areas: (a) the control room complex; (b) the SCA; (c) seismically qualified access or egress routes; (d) seismically qualified instrumentation rooms; (e) the containment structure; and (f) other areas identified in the seismic design basis. The fire suppression systems design shall prevent seismically induced failure, flooding, or the release of a fire suppression agent.	CSA N293-07 : Clause 7.4.2 Automatic fire suppression systems and all other fire protection equipment shall be seismically qualified to Category A for the following areas: (a) the control room complex; (b) the SCA; (c) seismically qualified access or egress routes; (d) instrumentation rooms; (e) the containment structure; and (f) other areas identified in the seismic design basis. The fire suppression systems design shall prevent seismically induced failure, flooding, or the release of a fire suppression agent.		Equivalent
7.4.3	In areas containing Category B seismically qualified SSCs, a Class I standpipe system, including its water supply, shall be qualified in accordance with seismic Category B. The seismically qualified standpipe system shall meet the flow and pressure design requirements for one Class I hose station in accordance with NFPA 14.	CSA N293-07 : Clause 7.4.3 In areas containing seismically qualified safety SSCs, a Class 1 standpipe system shall be qualified in accordance with seismic Category B. The seismically qualified standpipe system shall meet the flow and pressure design requirements for Class I in NFPA 14. Note: Seismic design and installation requirements extend to the water supply to ensure that the standpipe system is functional during and following a seismic event.	CSA N293-07 Clause 7.4.3 has an additional clarifying note no longer present in N293-12: "Seismic design and installation requirements extend to the water supply to ensure that the standpipe system is functional during and following a seismic event." Compliance with N293-07 Clause 7.4.3 therefore automatically implies compliance with N293-12 Clause 7.4.3.	Equivalent
8		CSA N293-07 : Clause 8		Equivalent
8.1*	Clause 8 provides detailed requirements for the fire protection program outlined in Clause 5.8 for the life cycle of the plant. The requirements of Clause 8 are in addition to the requirements of the NBCC and NFCC.	CSA N293-07 : Clause 8.1* Clause 8 provides detailed requirements for the fire protection program outlined in Clause 5.8 for the life cycle of the plant. The requirements of Clause 8 are in addition to the requirements of the NBCC and NFCC		Equivalent
8.2		CSA N293-07 : Clause 8.2		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.2.1		CSA N293-07 : Clause 8.2.1		Equivalent
8.2.1.1	A fire safety training needs analysis shall be performed to identify and document the staff training that is necessary. The needs analysis shall be based on a review of work activities, fire hazards, and required responses.	CSA N293-07 : Clause 8.2.1.1 A fire safety training needs analysis shall be performed to identify and document the staff training that is necessary. The needs analysis shall be based on a review of work activities, fire hazards, and required responses		Equivalent
8.2.1.2	All personnel who work in or access the protected area or buildings under the scope of this Standard shall be trained according to the requirements determined by the training needs analysis.	CSA N293-07 : Clause 8.2.1.2 All personnel who work in or access the protected area or buildings under the scope of this Standard shall be trained according to the requirements determined by the training needs analysis		Equivalent
8.2.1.3	Training shall be provided within one year of hire for all new staff. Staff with a term of employment of three months or less shall be exempt from this requirement. Note: This exemption does not apply to those involved in hot work or fire watch activities.	CSA N293-07 : Clause 8.2.1.3 Training shall be provided within one year of hire for all new staff. Staff with a term of employment of three months or less shall be exempt from this requirement. Note: This exemption does not apply to those involved in hot work or fire watch activities.		Equivalent
8.2.1.4	Fire safety training shall include, as a minimum, the following topics and procedures: (a) fire protection program goals; (b) basic fire prevention; (c) life safety; (d) the use of portable extinguishers; (e) emergency procedures; (f) the maintenance of egress routes; (g) fire equipment availability; (h) the control of transient material, hot work, and ignition sources, as identified and documented by the plant; and (i) the reporting of a fire.	CSA N293-07 : Clause 8.2.1.4 Fire safety training shall include, as a minimum, the following topics and procedures: (a) fire protection program goals; (b) basic fire prevention; (c) life safety; (d) the use of portable extinguishers; (e) emergency procedures; (f) the maintenance of egress routes; (g) fire equipment availability; (h) the control of transient material, hot work, and ignition sources, as identified and documented by the plant; and (i) the reporting of a fire.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.2.1.5	During initial training, all staff shall have hands-on training in the use of portable fire extinguishers. This training shall include practice using a portable fire extinguisher in the suppression of a live fire or interactive simulation acceptable to the AHJ.	CSA N293-07 : Clause 8.2.1.5 During initial training, all staff shall have hands-on training in the use of portable fire extinguishers. This training shall include practice using a portable fire extinguisher in the suppression of a live fire or interactive simulation acceptable to the AHJ.		Equivalent
8.2.1.6*	The re-qualification interval for those topics and procedures specified in Clause 8.2.1.4 shall be based on the training needs analysis, but shall in no case exceed three years.	CSA N293-07 : Clause 8.2.1.6* The re-qualification interval for those topics and procedures specified in Clause 8.2.1.4 shall be based on the training needs analysis, but shall in no case exceed three years.		Equivalent
8.2.1.7	For individuals involved in fire watch or hot work activities, hands-on training in the use of portable extinguishers shall be provided at intervals not exceeding three years.	CSA N293-07 : Clause 8.2.1.7 For individuals involved in fire watch or hot work activities, hands-on training in the use of portable extinguishers shall be provided at intervals not exceeding three years.		Equivalent
8.2.2	Housekeeping shall be performed in such a manner as to minimize the probability of fire and the consequences resulting from a fire.	CSA N293-07 : Clause 8.2.2 Housekeeping shall be performed in such a manner as to minimize the probability of fire and the consequences resulting from a fire.		Equivalent
8.2.3		CSA N293-07 : Clause 8.2.3		Equivalent
8.2.3.1	Combustible waste shall not be allowed to accumulate at work areas. A program shall be established for the staging, handling, and/or collecting of combustible waste. The intent of Clause 8.2.3.1 is to reduce the amount of combustible material waste to a level as low as is reasonably achievable.	CSA N293-07 : Clause 8.2.3.1* Combustible waste shall be relocated from the work area to an area designed for the staging, handling, or collecting of combustible waste immediately following the completion of work or at the end of the shift, whichever comes first. CSA N293-07 : Clause 8.2.3.2* Combustible dust shall not be allowed to accumulate on surfaces, cable trays, or on the inside or outside of ducting to a level that will propagate fire.	N293-12 Clause 8.2.3.1 combines and restates N293-07 Clauses 8.2.3.1 and 8.2.3.2, and adds a summary to apply ALARA to the amount of combustible waste. Equivalent intent to N293-07 Clause 8.2.3.1.	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.2.3.2	The combustible contents of buildings shall be minimized and, where practical, non-combustible alternatives shall be used. Panels and screens shall be of non-combustible materials or approved materials having fire-retardant characteristics. Tarpaulins, fabrics, or plastic films shall be certified in accordance with the testing specified in NFPA 701 or CAN/ULC-S109.	CSA N293-07 : Clause 8.2.3.3 The combustible contents of buildings shall be minimized and, where practical, non-combustible alternatives shall be used. Panels, tarpaulins, and screens shall be of non-combustible construction or approved materials having equivalent fire-retardant characteristics. Any other fabrics or plastic films shall be certified in accordance with the large-scale fire test in NFPA 701 or CAN/ULC-S109.		Equivalent
8.2.3.3*	When SSCs are replaced, repaired, or modified, combustible material components shall be identified and consideration shall be given as to whether there are non-combustible material alternatives available that can be substituted without impacting the design intent of the equipment.	CSA N293-07 : Clause 8.2.3.4 When SSCs are replaced, repaired, or modified, combustible material components shall be identified and consideration shall be given as to whether there are non-combustible material alternatives available that can be substituted without impacting the design intent of the equipment.		Equivalent
8.2.3.4		CSA N293-07 : Clause 8.2.3.5		Equivalent
8.2.3.4.1*	Combustible materials shall be stored in areas designed in accordance with Clause 6.5.1.	CSA N293-07 : Clause 8.2.3.5.1* Combustible materials shall be stored in accordance with Clause 6.8.5.	CSA N293-12 Clause 8.2.3.4.1 references the more general clause 6.5.1 re combustible material storage rather than the more specific clause and superseded CSA N293-07 Clause 6.8.5	Equivalent
8.2.3.4.2	Combustible materials, including fire-retardant coated or treated combustible materials, shall not be stored in the containment structure or in areas designated as sensitive by the FPA.	CSA N293-07 : Clause 8.2.3.5.2 Combustible materials, including fire-retardant coated or treated combustible materials, shall not be stored in the containment structure or in areas designated as sensitive by the FSSA.	The N293-07 8.2.3.5.2 reference to the FSSA is more generally replaced by the N293-12 Clause 8.2.3.4.2 reference to the FPA.	Equivalent
8.2.3.4.3*	Transient materials shall be minimized and controlled.	CSA N293-07 : Clause 8.2.3.5.3* Transient materials shall be minimized and controlled.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.2.3.4.4*	Wood shall only be used where there is no reasonable alternative. Where wood is used, it shall be qualified as fire-retardant-treated-wood in accordance with the National Code of Canada. Fire-retardant-treated- wood means wood or a wood product that has had its surface-burning characteristics, such as flame spread, rate of fuel contribution, and density of smoke developed, reduced by impregnation with fire retardant chemicals. Wood blocks larger than 150 × 150 mm shall not require fire-retardant treatment.	CSA N293-07 : Clause 8.2.3.5.4* Wood shall only be used where there is no reasonable alternative. Where wood is used, it shall be listed as non-leaching by UL or ULC, approved by FM as being pressure-treated or coated with a fire-retardant treatment, or coated in accordance with CAN/ULC-S102. Wood blocks larger than 150 x 150 mm (6 x 6 in) shall not require fire-retardant treatment.		Equivalent
8.2.3.4.5*	Where wood is treated in accordance with Clause 8.2.3.4.4, it shall be inspected prior to each use to ensure that the treatment or coating is intact. Where the treatment or coating is not intact, the wood shall be re-treated or re-coated.	CSA N293-07 : Clause 8.2.3.5.5* Where wood is treated or coated in accordance with Clause 8.2.3.5.4, it shall be inspected prior to each use to ensure that the treatment or coating is intact. Where the treatment or coating is not intact, the wood shall be re-treated or re-coated.		Equivalent
8.2.3.4.6	Where wood is treated in accordance with Clause 8.2.3.4.4, ends of wood pieces shall be treated or coated after the wood has been cut.	CSA N293-07 : Clause 8.2.3.5.6 Where wood is treated or coated in accordance with Clause 8.2.3.5.4, ends of wood pieces shall be treated or coated after the wood has been cut.		Equivalent
8.2.3.5		CSA N293-07 : Clause 8.2.3.6		Equivalent
8.2.3.5.1	Radioactive materials shall only be handled, used, and stored in areas designated for these purposes.	CSA N293-07 : Clause 8.2.3.6.1 Radioactive materials shall only be handled, used, and stored in areas designated for these purposes.		Equivalent
8.2.3.5.2*	Radioactive materials shall be stored in areas designed in accordance with Clause 6.8.8.	CSA N293-07 : Clause 8.2.3.6.2 Radioactive materials shall be stored in accordance with Clause 6.8.9.		Equivalent
8.2.3.5.3	Combustible materials shall not be stored in the same fire compartment as radioactive materials unless the fire compartment is a radioactive waste storage room in accordance with Clause 6.8.8.	CSA N293-07 : Clause 8.2.3.6.3 Combustible materials shall not be stored in the same fire compartment as radioactive materials unless the fire compartment is a radioactive waste storage room in accordance with Clause 8.2.3.6.4.	N293-07 Clause 8.2.3.6.3 cites 8.2.3.6.4 for radioactive waste storage rooms, while N293-12 Clause 8.2.3.5.3 cites the more specific Clause 6.8.8. Equivalent intent.	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.2.3.5.5*	Radioactive materials shall be stored such that they are protected from fires and firefighting activities.	CSA N293-07 : Clause 8.2.3.6.5* Radioactive materials shall be stored such that they are protected from fires and firefighting activities.		Equivalent
8.2.3.6		CSA N293-07 : Clause 8.2.3.7		Equivalent
8.2.3.6.1*	The control of fire loads in the protected area and areas under the scope of this Standard is essential to providing defence-in-depth fire protection. This includes controlling the construction, location, contents, and use of relocatable structures.	CSA N293-07 : Clause 8.2.3.7.1* The control of fire loads in the protected area and areas under the scope of this Standard is essential to providing defence-in-depth fire protection. This includes controlling the construction, location, contents, and use of relocatable structures.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.2.3.6.2*	Relocatable structures intended for human occupancy, including associated walkways, stairways, insulation, and skirting, shall comply with the requirements of this Standard and shall be (a) constructed using non-combustible construction, as defined in the NBCC; (b) located in accordance with the NBCC; (c) assessed for additional fire protection provisions in accordance with the objectives of Clause 5.5; (d) equipped with a fire alarm system in accordance with Clause 7.2. This system shall communicate with the CACF and provide information to identify a fire condition or trouble situation affecting a structure and shall identify the structure's location; (e) equipped with portable fire extinguishers, in accordance with Clause 7.3.5; (f) where located outside a building, assessed to determine whether an automatic fire suppression system is required in addition to the requirements of this Standard; and (g) where located inside a building, protected by a fire suppression system that is installed in accordance with this Standard. Note: The requirements of Clause 8.2.3.6.2 except for Clause 8.2.3.6.2, Item (e), do not apply to existing relocatable structures unless moved or relocated. These structures still require assessment under the FPA.	CSA N293-07 : Clause 8.2.3.7.2* Relocatable structures shall comply with the requirements of this Standard and shall be (a) constructed of non-combustible materials, as defined in the NBCC; Note: This includes materials for walkways, stairways, insulation, and skirting. (b) located in accordance with the NBCC; (c) assessed for additional fire protection provisions in accordance with the objectives of Clause 5.5; (d) equipped with a fire alarm system in accordance with Clause 7. This system shall communicate with the CACF and provide information to identify a fire condition or trouble situation affecting a structure and shall identify the structure's location; (e) equipped with portable fire extinguishers, in accordance with Clause 7; (f) where located outside a building, assessed to determine whether an automatic fire suppression system is required in addition to the requirements of this Standard; and (g) where located inside a building, protected by a fire suppression system that is installed in accordance with this Standard.	N293-12 Clause 8.2.3.6.2 has an additional clarifying Note that its requirements, other than Item (e), do not apply to existing relocatable structures unless moved or relocated; and that these structures still require assessment under the FPA. Equivalent in intent.	Equivalent
8.2.3.6.3	A visual inspection of the fire alarm and fire suppression systems shall be performed after each relocation of the structure.	CSA N293-07 : Clause 8.2.3.7.3 A visual inspection of the fire alarm and fire suppression systems shall be performed after each relocation of the structure.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.2.3.6.4*	Prior to the installation of a relocatable structure, the plant FPA shall be reviewed and the impact of the structure shall be assessed. Where the structure impacts the plant, the FPA shall be updated.	CSA N293-07 : Clause 8.2.3.7.4* Prior to the installation of a relocatable structure, the plant FHA shall be reviewed and the impact of the structure shall be assessed. Where the structure impacts the plant, the FHA shall be updated.	The N293-07 8.2.3.7.4 reference to the FHA is more generally replaced by the N293-12 Clause 8.2.3.6.4 reference to the FPA.	Equivalent
8.2.3.7	Thermal insulating materials	CSA N293-07 : Clause 8.2.3.8 Thermal insulating materials		Equivalent
8.2.3.7.1	Thermal insulating materials shall be provided with suitable protective coverings or drip guards to prevent them from absorbing flammable or combustible liquids or from being physically damaged.	CSA N293-07 : Clause 8.2.3.8.1 Thermal insulating materials shall be provided with suitable protective coverings or drip guards to prevent them from absorbing flammable or combustible liquids or from being physically damaged.		Equivalent
8.2.3.7.2	Following the completion of a maintenance activity on insulated equipment, the insulation shall be inspected to ensure that it has not absorbed any flammable or combustible liquids and has not deteriorated in any way.	CSA N293-07 : Clause 8.2.3.8.2 Following the completion of a maintenance activity on insulated equipment, the insulation shall be inspected to ensure that it has not absorbed any flammable or combustible liquids and has not deteriorated in any way.		Equivalent
8.2.3.7.3	Insulating materials that have been exposed to flammable or combustible liquids or that exhibit signs of deterioration shall be replaced.	CSA N293-07 : Clause 8.2.3.8.3 Insulating materials that have been exposed to flammable or combustible liquids or that exhibit signs of deterioration shall be replaced.		Equivalent
8.2.4		CSA N293-07 : Clause 8.2.4		Equivalent
8.2.4.1	Dangerous goods shall be handled, used, and stored in accordance with the NFCC.	CSA N293-07 : Clause 8.2.4.1 Dangerous goods shall be handled, used, and stored in accordance with the NFCC		Equivalent
8.2.4.2	Administrative procedures shall manage the location, condition, and contents of flammable liquid cabinets to limit their numbers and inventory to those necessary for the operation of the plant.	CSA N293-07 : Clause 8.2.4.2 Administrative procedures shall manage the location, condition, and contents of flammable liquid cabinets to limit their numbers and inventory to those necessary for the operation of the plant.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.2.4.3	Flammable liquids, flammable solids, combustible liquids, and flammable gases shall not be stored in the containment structure.	CSA N293-07 : Clause 8.2.4.3 Flammable liquids, flammable solids, combustible liquids, and flammable gases shall not be stored in the containment structure.		Equivalent
8.2.4.4	Compressed gases and cryogenic fluids in portable and stationary containers, cylinders, and tanks shall be stored, used, maintained, and inspected in accordance with the requirements of the NFCC and NFPA 55.	CSA N293-07 : Clause 8.2.4.5 Compressed gases and cryogenic fluids in portable and stationary containers, cylinders, and tanks shall be stored, used, maintained, and inspected in accordance with the requirements of the NFCC and NFPA 55.		Equivalent
8.2.4.5	Transient compressed gases and cryogenic fluids shall not be handled, used, located, or stored near safety-related equipment unless an assessment determines the consequence of failure is acceptable.	CSA N293-07 : Clause 8.2.4.6 Transient compressed gases and cryogenic fluids shall not be handled, used, located, or stored near safety-related equipment unless an assessment determines the consequence of failure is acceptable.		Equivalent
8.2.4.6	The amount of transient compressed gas or cryogenic fluids located in portable containers, cylinders, or tanks shall be minimized.	CSA N293-07 : Clause 8.2.4.7 The amount of transient compressed gas or cryogenic fluids located in portable containers, cylinders, or tanks shall be minimized.		Equivalent
8.2.4.7	Aerosols shall be handled, used, and stored in accordance with the requirements of the NFCC and NFPA 30B.	CSA N293-07 : Clause 8.2.4.8 Aerosols shall be handled, used, and stored in accordance with the requirements of the NFCC and NFPA 30B.		Equivalent
8.2.4.8	The handling and storage of dangerous goods shall not be located near the control room or other areas that contain safety-related systems.	CSA N293-07 : Clause 8.2.4.9 The handling and storage of dangerous goods shall not be located near the control room or other areas that contain safety-related systems.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.2.5*	A hot work procedure and permit system shall be developed and implemented in accordance with the requirements of the NFCC. In addition to the requirements of the NFCC, hot work roofing activities shall be checked 2 h and 3 h after the completion of work. These checks shall be done with the use of a thermal imaging camera.	CSA N293-07 : Clause 8.2.5* A hot work procedure and permit system shall be developed and implemented in accordance with the requirements of the NFCC. In addition to the requirements of the NFCC, hot work roofing activities shall be checked 2 h and 3 h after the completion of work. These checks shall be done with the use of a thermal imaging camera.		Equivalent
8.2.6	Smoking shall be prohibited, except where allowed by applicable by-laws or statutes. Where permitted by applicable by-laws or statutes, smoking shall only take place in designated smoking areas.	CSA N293-07 : Clause 8.2.6 Smoking shall be prohibited, except where allowed by applicable by-laws or statutes. Where permitted by applicable by-laws or statutes, smoking shall only take place in designated smoking areas.		Equivalent
8.2.7*		CSA N293-07 : Clause 8.2.7*		Equivalent
8.2.7.1	Combustible material, other than that forming part of the approved facilities design, that is located outside of storage areas shall be eliminated where possible or, when required, minimized, controlled, located, and analyzed under a transient material control process such that a fire involving the material is precluded from damaging safety-related systems, or fire safe shutdown SSCs.	CSA N293-07 : Clause 8.2.7.1 Combustible material, other than that forming part of the approved facilities design, that is located outside of storage areas shall be eliminated where possible and, when required, minimized, controlled, located, and analyzed under a transient material control process such that a fire involving the material is precluded from damaging safety-related systems, safety systems, or fire safe shutdown systems, structures, or components.	N293-12 Clause 8.2.7.1 mentions damage to safety-related systems, while N293-07 Clause 8.2.7.1 mentions damage to safety-related systems or safety systems. Equivalent intent.	Equivalent
8.2.7.2	Areas of the facility that contain safety-related systems or fire safe shutdown SSCs shall not be used for the maintenance, charging, storage, or parking (temporary or permanent) of vehicles (e.g., sweepers, motorized hand trucks, forklifts, tractors, and industrial trucks).	CSA N293-07 : Clause 8.2.7.2 Areas of the facility that contain safety-related systems, safety systems, or fire safe shutdown systems, structures, or components shall not be used for the maintenance, charging, storage, or parking (temporary or permanent) of vehicles (e.g., sweepers, motorized hand trucks, forklifts, tractors, and industrial trucks).	N293-12 Clause 8.2.7.2 mentions damage to safety-related systems, while N293-07 Clause 8.2.7.2 mentions damage to safety-related systems or safety systems. Equivalent intent.	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.2.7.3*	Ignition sources (e.g., hot work, vehicles, temporary equipment or wiring, portable heaters, and portable lighting) other than those forming part of the approved facilities design shall be eliminated where possible or, when required, minimized, controlled, located, and analyzed under an ignition source control process so as to prevent the ignition of combustibles and minimize the hazard posed in areas of the facility that contain safety-related systems or fire safe shutdown SSCs.	CSA N293-07 : Clause 8.2.7.3* Ignition sources (e.g., hot work, vehicles, temporary equipment or wiring, portable heaters, and portable lighting) other than those forming part of the approved facilities design shall be eliminated where possible and, when required, minimized, controlled, located, and analyzed under an ignition source control process so as to prevent the ignition of combustibles and minimize the hazard posed in areas of the facility that contain safety-related systems, safety systems, or fire safe shutdown systems, structures, or components.		Equivalent
8.2.8		CSA N293-07 : Clause 8.2.8		Equivalent
8.2.8.1	Work activities shall be planned and coordinated in accordance with the fire protection goals of this Standard.	CSA N293-07 : Clause 8.2.8.1 Work activities shall be planned and coordinated in accordance with the fire protection goals of this Standard.		Equivalent
8.2.8.2*	Work activities and control of transient materials shall be planned and managed to ensure that (a) egress paths are not obstructed; (b) access paths to firefighting equipment are not obstructed; (c) firefighting activities are not compromised; (d) operator field actions are not compromised; and (e) their potential impacts on nuclear safety have been evaluated and minimized.	CSA N293-07 : Clause 8.2.8.2* Work activities and control of transient materials shall be planned and managed to ensure that (a) egress paths are not obstructed; (b) access paths to firefighting equipment are not obstructed; (c) firefighting activities are not compromised; (d) operator field actions are not compromised; and (e) their potential impacts on nuclear safety have been evaluated and minimized.		Equivalent
8.2.9*		CSA N293-07 : Clause 8.2.9*		Equivalent
8.2.9.1	The industrial fire brigade shall be notified of an identified emergency incident within 1 min of the CACF being notified of the emergency.	CSA N293-07 : Clause 8.2.9.1 The industrial fire brigade shall be notified of an identified emergency incident within 1 min of the CACF being notified of the emergency.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.2.9.2*	Fire incidents shall be investigated. The depth of investigation or analysis shall be determined by the severity of the fire and risk to occupants, environment, and nuclear safety. The scope of any investigation related to economic loss shall be determined by the licensee.	CSA N293-07 : Clause 8.2.9.2* Fire incidents shall be investigated. The depth of investigation or analysis shall be determined by the severity of the fire and risk to occupants, environment, and nuclear safety. The scope of any investigation related to economic loss shall be determined by the licensee.		Equivalent
8.2.9.3	The AHJ shall be notified of any incident that (a) causes personal injury or property damage; (b) results in the mobilization of the emergency response team; or (c) causes fires that result in, or have significant potential to result in, an operating transient.	CSA N293-07 : Clause 8.2.9.3 The AHJ shall be notified of (a) any uncontrolled combustion, not restricted to open flame, that causes personal injury or property damage, or that results in the mobilization of the emergency response team; or (b) fires that result in, or have significant potential to result in, an operating transient.	Similar wording	Equivalent
8.2.9.4	A system shall be developed for each plant that identifies and trends fire incidents, as well as any corrective actions taken. Where deficiencies are identified, action plans shall be developed and implemented to prevent the occurrence of similar incidents.	CSA N293-07 : Clause 8.2.9.4 A system shall be developed for each plant that identifies and trends fire incidents as well as any corrective actions taken. Where deficiencies are identified, action plans shall be developed and implemented to prevent the occurrence of similar incidents.		Equivalent
8.2.9.5	The investigation specified in Clause 8.2.9.2 shall also determine the impact on the future performance of the SSCs exposed to fire.	CSA N293-07 : Clause 8.2.9.6 The investigation specified in Clause 8.2.9.2 shall also determine the impact on the future performance of the equipment exposed to fire.		Equivalent
8.3		CSA N293-07 : Clause 8.3		Equivalent
8.3.1		CSA N293-07 : Clause 8.3.1		Equivalent
8.3.1.1*	The inspection, testing, maintenance, and operation of fire protection equipment shall comply with the requirements of this Standard.	CSA N293-07 : Clause 8.3.1.1* The inspection, testing, maintenance, and operation of fire protection equipment shall comply with the requirements of this Standard.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.3.1.2*	A performance-based inspection, testing, and maintenance program may be implemented with the concurrence of the AHJ. The performance-based program shall be in accordance with Clauses 4.4 and 4.5 and the NFCC requirements for equivalencies or alternatives.	CSA N293-07 : Clause 8.3.1.2* A performance-based inspection, testing, and maintenance program may be implemented with the agreement of the AHJ. The performance-based program shall be in accordance with Clauses 4.6 and 4.7 and the NFCC requirements for equivalencies or alternatives		Equivalent
8.3.2*	When a fire protection system is out of service, compensatory measures shall be provided. Impairments to fire protection systems shall be managed through the development of an impairment plan. The impairment plan shall meet the following requirements: (a) The duration of the impairment shall be the shortest period possible. (b) The AHJ shall be notified of the impairment within 24 h, and a copy of the impairment plan shall be submitted to the AHJ where (i) the impairment results in a fire protection system being unavailable to meet its design intent for a period longer than 12 h; or (ii) the fire protection system is specified in the FPA as protecting fire safe shutdown equipment. (c) Post-maintenance testing shall be performed as required to ensure system functionality. (d) Impairments shall be monitored and delays in return to service shall be reported to management. (e) The impairment plan shall ensure that adequate measures are taken during the impairment to minimize the potential for increased risks. (f) The industrial fire brigade shall be informed of all fire protection system impairments. (g) A written procedure shall be developed and implemented to manage the impairment. As a minimum, the procedure shall include (i) compensatory measures to manage and	CSA N293-07 : Clause 8.3.2* When a fire protection system is out of service, compensatory measures shall be provided. Impairments to fire protection systems shall be managed through the development of an impairment plan. The impairment plan shall meet the following requirements: (a) The duration of the impairment shall be the shortest period possible. (b) The AHJ shall be notified of the impairment within 24 h, and a copy of the impairment plan shall be submitted to the AHJ where (i) the impairment results in a fire protection system being unavailable to meet its design intent for a period longer than 12 h; or (ii) the fire protection system is specified in the FSSA as protecting fire safe shutdown equipment. (c) Post-maintenance testing shall be performed as required to ensure system functionality. (d) Impairments shall be monitored and delays in return to service shall be reported to management. (e) The impairment plan shall ensure that adequate measures are taken during the impairment to minimize the potential for increased risks. (f) The industrial fire brigade shall be informed of all fire protection system impairments. (g) A written procedure shall be developed and implemented to manage the impairment. At a minimum, the procedure shall include	The N293-07 8.3.2 reference to the FSSA is more generally replaced by the N293-12 Clause 8.3.2 reference to the FPA. Equivalent intent.	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
	minimize the risk associated with the impairment; (ii) identification, tagging, and locking out of all impaired fire equipment and fire systems; (iii) notification of impairment to appropriate personnel, including plant staff, off-site monitoring companies, in-plant and off-site emergency responders, and others affected by the impairment; (iv) required action and notification following the return of impaired equipment and systems to operational service, including post-maintenance testing requirements; (v) additional activities to minimize risk and ensure life safety; and (vi) inspection and oversight necessary to monitor the implementation of procedures during the impairment. (h) Compensatory measures shall be provided for impairments to the very early warning detection system(s) located in the control equipment room(s) and control computer room(s).	(i) compensatory measures to manage and minimize the risk associated with the impairment; (ii) identification, tagging, and locking out of all impaired fire equipment and fire systems; (iii)notification of impairment to appropriate personnel, including plant staff, off-site monitoring companies, in-plant and off-site emergency responders, and others impacted by the impairment; (iv) required action and notification following the return of impaired equipment and systems to operational service, including post-maintenance testing requirements; (v) additional activities to minimize risk and ensure life safety; and (vi) inspection and oversight necessary to monitor the implementation of procedures during the impairment. (h) Compensatory measures shall be provided for impairments to the very early warning detection system(s) located in the control equipment room(s) and control computer room(s).		
8.3.3		CSA N293-07 : Clause 8.3.3		Equivalent
8.3.3.1*	In addition to inspection requirements of the NFCC, the following inspections shall be conducted: (a) Combustible-material-free fire zones, as identified in the FPA, shall be inspected once per day to ensure that no unauthorized combustible materials or fire hazards are present. Where these areas are inaccessible, alternative measures shall be taken to ensure compliance. (b) Welding and other hot work areas (permanent or temporary) shall be inspected at the start of work activities to ensure adequate provisions are in place to prevent the start of fire and to determine that the area is free of unnecessary combustible materials. (c) Areas with high fire hazards and fire sensitive areas, as identified in the FPA, shall be inspected once	CSA N293-07 : Clause 8.3.3.1* In addition to inspection requirements of the NFCC, the following inspections shall be conducted: (a) Combustible-material-free fire zones, as identified in the FSSA, shall be inspected once per day to ensure that no unauthorized combustible materials or fire hazards are present. Where these areas are inaccessible, alternative measures shall be taken to ensure compliance. (b) Welding and other hot work areas (permanent or temporary) shall be inspected at the start of work activities to ensure adequate provisions are in place to prevent the start of fire and to determine that the area is free of unnecessary combustible materials.	The N293-07 8.3.3.1 reference to the FSSA is more generally replaced by the N293-12 Clause 8.3.3.1 reference to the FPA. Equivalent intent.	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
	per day for unsafe conditions that include unauthorized combustible materials, fire hazards, and obstructions to emergency response (e.g., firefighting actions). (d) Doors that are identified in the FPA as fire barriers ensuring fire safe shutdown shall be inspected once per week. (e) Fire barriers (including performance barriers) shall be inspected for degradation or violation. A minimum of 10% of fire barriers shall be inspected each year so that all fire barriers are inspected over a ten-year period.	(c) Areas with high fire hazards and fire sensitive areas, as identified in the FSSA, shall be inspected once per day for unsafe conditions that include unauthorized combustible materials, fire hazards, and obstructions to emergency response (e.g., firefighting actions). (d) Doors that are identified in the FSSA as fire barriers ensuring fire safe shutdown shall be inspected once per week. (e) Fire barriers (including performance barriers) shall be inspected for degradation or violation. A minimum of 10% of fire barriers shall be inspected each year so that all fire barriers are inspected over a ten-year period.		
8.3.4		CSA N293-07 : Clause 8.3.4		Equivalent
8.3.4.1*	A fire protection program audit is an assessment of each program element to confirm compliance with this Standard and other applicable Codes, Standards, and industry best practices in fire protection. The fire protection program audit shall (a) be performed in accordance with CSA N286 by a qualified third party external to the owner or operator of the plant at least once every three years. The audit may be conducted over a three-year period, provided that all aspects of plant operation are reviewed at least once every three years in accordance with this Standard; and (b) review areas of identified weakness in the fire protection program and areas containing precursors to unsafe fire conditions.	CSA N293-07 : Clause 8.3.4.1* A fire protection program audit is an assessment of each program element to confirm compliance with this Standard and other applicable Codes, Standards, and industry best practices in fire protection. The fire protection program audit shall be performed in accordance with CSA N286 by a qualified third party external to the owner or operator of the plant at least once every three years. The audit may be conducted over a three-year period, provided that all aspects of plant operation are reviewed at least once every three years in accordance with this Standard; and review areas of identified weakness in the fire protection program and areas containing precursors to unsafe fire conditions.		Equivalent
8.3.4.2	The fire protection program audit shall, as a minimum, review (a) documentation and records to demonstrate compliance with this Standard; Note: Compliance can include conformance with applicable Standards, use of industry best practices, and meeting inspection, testing, and maintenance	CSA N293-07 : Clause 8.3.4.2 The fire protection program audit shall, as a minimum, review (a) documentation and records to demonstrate compliance with this Standard; Note: Compliance can include conformance with applicable Standards, use of industry best practices, and	The N293-07 8.3.4.2 reference to the FSSA is more generally replaced by the N293-12 Clause 8.3.4.2 reference to the FPA.	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
	requirements. (b) fire incidents and follow-up actions; (c) the role of the industrial fire brigade and their responses to incidents; (d) procedures related to the fire protection program; (e) fire protection procedures for inclusion of industry operating experience and evolving industry standards; (f) representative samples of the fire protection inspection, testing, and maintenance program; (g) a sample of plant modifications to ensure compliance with the NBCC and NFCC, as well as to ensure that the impact on the FPA has been evaluated; (h) at least one emergency response team drill, through direct observation, and assessment of performance levels; (i) identified adverse conditions and their corrective actions, in addition to actual fire incidents. This review shall include the response or corrective actions of management and of the fire protection organization, including the industrial fire brigade; (j) compliance with fire procedures by performing a field inspection of selected areas for procedures such as housekeeping and control of hazards; and (k) the plant's documented fire protection program for compliance and alignment with Codes, Standards, and good practice.	meeting inspection, testing, and maintenance requirements. (b) fire incidents and follow-up actions; (c) the role of the industrial fire brigade and their responses to incidents; (d) procedures related to the fire protection program; (e) fire protection procedures for inclusion of industry OPEX and evolving industry standards; (f) representative samples of the fire protection inspection, testing, and maintenance program; (g) a sample of plant modifications to ensure compliance with the NBCC and NFCC, as well as to ensure that the impact on the FSSA has been evaluated; (h) at least one emergency response team drill, through direct observation, and assess performance levels; (i) identified adverse conditions and their corrective actions, in addition to actual fire incidents. This review shall include the response or corrective actions of management and of the fire protection organization, including the industrial fire brigade; (j) compliance with fire procedures by performing a field inspection of selected areas for procedures such as housekeeping and control of hazards; and (k) the plant's documented fire protection program for compliance and alignment with Codes, Standards, and good practice.		
8.3.5*		CSA N293-07 : Clause 8.3.5*		Equivalent
8.3.5.1	A plant condition inspection shall be performed by a qualified third party at least once per year.	CSA N293-07 : Clause 8.3.5.1 A plant condition inspection shall be performed by a qualified third party at least once per year.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
8.3.5.2	The plant condition inspection shall consist of a visual inspection of the plant (i.e., a walkdown) to confirm compliance with this Standard and the NFCC.	CSA N293-07 : Clause 8.3.5.2 The plant condition inspection shall consist of a visual inspection of the plant (i.e., a walkdown) to confirm compliance with this Standard and the NFCC.		Equivalent
9		CSA N293-07 : Clause 9		Equivalent
9.1		CSA N293-07 : Clause 9.1		Equivalent
9.1.1	Clause 9 specifies requirements for the three phases of the decommissioning process, which are (a) mothballing; (b) encasement; and (c) dismantling and removal.	CSA N293-07 : Clause 9.1.1 Clause 9 specifies requirements for the three phases of the decommissioning process, which are (a) mothballing; (b) encasement; and (c) dismantling and removal.		Equivalent
9.1.2	Clause 9 is not intended to apply to plants in a laid-up state where the intention is to restart.	CSA N293-07 : Clause 9.1.2 Clause 9 is not intended to apply to plants in a laid-up state where the intention is to restart		Equivalent
9.1.3	Site fire safety shall be provided in accordance with the NFCC. Demolition activities shall be conducted in accordance with Division B, Section 5.6 of the NFCC and with NFPA 241.	CSA N293-07 : Clause 9.1.3 Site fire safety shall be provided in accordance with the NFCC. Demolition activities shall be conducted in accordance with Division B, Section 5.6 of the NFCC and with NFPA 241.		Equivalent
9.1.4*	A fire safety plan shall be prepared and maintained for all stages of decommissioning.	CSA N293-07 : Clause 9.1.4* A fire safety plan shall be prepared and maintained for all stages of decommissioning.		Equivalent
9.2*		CSA N293-07 : Clause 9.2*		Equivalent
9.2.1	Mothballing is the stage of the decommissioning process when the reactor containment is retained but all fuel and radioactive materials are removed.	CSA N293-07 : Clause 9.2.1 Mothballing is the stage of the decommissioning process when the reactor containment is retained but all fuel and radioactive materials are removed		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
9.2.2	The FPA shall be maintained through the mothballing phase of the plant.	CSA N293-07 : Clause 9.2.2 The FHA shall be maintained through the mothballing phase of the plant.	The N293-07 9.2.2 reference to the FHA is more generally replaced by the N293-12 Clause 9.2.2 reference to the FPA.	Equivalent
9.2.3	Where practical, combustible materials shall be removed from the plant.	CSA N293-07 : Clause 9.2.3 Where practical, combustible materials shall be removed from the plant.		Equivalent
9.2.4	Ignition sources shall be managed in accordance with Clause 8.	CSA N293-07 : Clause 9.2.4 Ignition sources shall be managed in accordance with Clause 8.		Equivalent
9.2.5	Accessible areas of the plant shall be provided with a fire alarm system using detection as required by the NBCC and the FPA. The system shall signal an alarm at a constantly staffed location on site.	CSA N293-07 : Clause 9.2.5 Accessible areas of the plant shall be provided with a fire alarm system using detection as required by the NBCC and the FHA. The system shall signal an alarm at a constantly staffed location on site.	The N293-07 9.2.5 reference to the FHA is more generally replaced by the N293-12 Clause 9.2.5 reference to the FPA.	Equivalent
9.2.6	Fire exits shall be maintained in accordance with the NFCC.	CSA N293-07 : Clause 9.2.6 Fire exits shall be maintained in accordance with the NFCC.		Equivalent
9.2.7	The fire protection water supply system shall be maintained to supply hydrants, standpipes, hoses, and all other fire protection systems in service in accessible locations.	CSA N293-07 : Clause 9.2.7 The fire protection water supply system shall be maintained to supply hydrants, standpipes, hoses, and all other fire protection systems in service in accessible locations		Equivalent
9.2.8	Fire separation shall be provided and maintained in accordance with the FPA.	CSA N293-07 : Clause 9.2.8 Fire separation shall be provided and maintained in accordance with the FHA.	The N293-07 9.2.8 reference to the FHA is more generally replaced by the N293-12 Clause 9.2.8 reference to the FPA.	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
9.2.9	In multi-unit plants, the units can be at different stages in the decommissioning process. The FPA for the operating unit(s) shall include a review of the impact of the mothballed unit on the operating unit(s). Services (e.g., electricity, air supplies) routed through mothballed areas shall be protected.	CSA N293-07 : Clause 9.2.9 In multi-unit plants, the units can be at different stages in the decommissioning process. The FHA for the operating unit(s) shall include a review of the impact of the mothballed unit on the operating unit(s). Services (e.g., electricity, air supplies) routed through mothballed areas shall be protected.	The N293-07 9.2.9 reference to the FHA is more generally replaced by the N293-12 Clause 9.2.9 reference to the FPA.	Equivalent
9.3		CSA N293-07 : Clause 9.3		Equivalent
9.3.1	Encasement is the stage of the decommissioning process when all easily removed parts have been dismantled and removed, and remaining radioactive materials are encased inside some form of shielding structure.	CSA N293-07 : Clause 9.3.1 Encasement is the stage of the decommissioning process when all easily removed parts have been dismantled and removed, and remaining radioactive materials are encased inside some form of shielding structure.		Equivalent
9.3.2	The FPA shall be maintained for the plant during the encasement phase, and the consequences of fires on the encased areas shall be assessed.	CSA N293-07 : Clause 9.3.2 The FHA shall be maintained for the plant during the encasement phase, and the consequences of fires on the encased areas shall be assessed.	The N293-07 9.3.2 reference to the FHA is more generally replaced by the N293-12 Clause 9.3.2 reference to the FPA, including in the change of clause title. Equivalent intent.	Equivalent
9.3.3	All combustible materials and ignition sources shall be removed from encased areas.	CSA N293-07 : Clause 9.3.3 All combustible materials and ignition sources shall be removed from encased areas		Equivalent
9.3.4	The encasement shall be constructed to ensure its integrity in the event of an external fire. The fire resistance of this encasement shall be determined by the FPA in accordance with the fire loading of the remainder of the protected area or the adjacent outside grounds.	CSA N293-07 : Clause 9.3.4 The encasement shall be constructed to ensure its integrity in the event of an external fire. The fire resistance of this encasement shall be determined by the FHA in accordance with the fire loading of the remainder of the protected area or the adjacent outside grounds.	The N293-07 9.3.4 reference to the FHA is more generally replaced by the N293-12 Clause 9.3.4 reference to the FPA.	Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
9.3.5	The fire protection water supply system shall be maintained to supply hydrants, standpipes, hoses, and all other in-service fire protection systems in accessible locations.	CSA N293-07 : Clause 9.3.5 The fire protection water supply system shall be maintained to supply hydrants, standpipes, hoses, and all other in-service fire protection systems in accessible locations		Equivalent
9.3.6	In multi-unit plants, the units can be at different stages in the decommissioning process. The FPA for the operating unit(s) shall include a review of the impact of the encased unit on the operating unit(s).	CSA N293-07 : Clause 9.3.6 In multi-unit plants, the units can be at different stages in the decommissioning process. The FHA for the operating unit(s) shall include a review of the impact of the encased unit on the operating unit(s).	The N293-07 9.3.6 reference to the FHA is more generally replaced by the N293-12 Clause 9.3.6 reference to the FPA.	Equivalent
9.4		CSA N293-07 : Clause 9.4		Equivalent
9.4.1	Dismantling and removal is the stage of the decommissioning process when all remaining parts of the plant are dismantled and removed or buried.	CSA N293-07 : Clause 9.4.1 Dismantling and removal is the stage of the decommissioning process when all remaining parts of the plant are dismantled and removed or buried.		Equivalent
9.4.2	An FPA shall be maintained during the plant dismantling and removal phase, and the consequences of fires shall be assessed.	CSA N293-07 : Clause 9.4.2 An FHA shall be maintained during the plant dismantling and removal phase, and the consequences of fires shall be assessed.	The N293-07 9.4.2 reference to the FHA is more generally replaced by the N293-12 Clause 9.4.2 reference to the FPA, including in the change of clause title. Equivalent intent.	Equivalent
9.4.3	Where practical, combustible materials shall be removed from the demolition site.	CSA N293-07 : Clause 9.4.3 Where practical, combustible materials shall be removed from the demolition site		Equivalent
9.4.4	The fire protection water supply and fire hydrants shall be functional until work is completed.	CSA N293-07 : Clause 9.4.4 The fire protection water supply and fire hydrants shall be functional until work is completed		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
9.4.5	After the removal of the building fire alarm system, fire detection shall be provided by a fire watch that makes regular rounds of the site. The fire watch shall continue until the building is demolished or until all fire hazards are removed.	CSA N293-07 : Clause 9.4.5 After the removal of the building fire alarm system, fire detection shall be provided by a fire watch that makes regular rounds of the site. The fire watch shall continue until the building is demolished or until all fire hazards are removed.		Equivalent
9.4.6*	An on-site fire brigade shall be organized in accordance with Clause 10 and NFPA 600. The fire brigade shall remain in service until all fire hazards have been removed from the site.	CSA N293-07 : Clause 9.4.6* An on-site fire brigade shall be organized in accordance with Clause 10 and NFPA 600. The fire brigade shall remain in service until all fire hazards have been removed from the site.		Equivalent
9.4.7	In multi-unit plants, the units can be at different stages of the decommissioning process. The FPA for the operating unit(s) shall include a review of the impact of the unit being dismantled on the other unit(s). Services (e.g., electricity, air supplies) shall be protected during the dismantling phase.	CSA N293-07 : Clause 9.4.7 In multi-unit plants, the units can be at different stages of the decommissioning process. The FHA for the operating unit(s) shall include a review of the impact of the unit being dismantled on the other unit(s). Services (e.g., electricity, air supplies) shall be protected during the dismantling phase.	The N293-07 9.4.7 reference to the FHA is more generally replaced by the N293-12 Clause 9.4.7 reference to the FPA.	Equivalent
10		CSA N293-07 : Clause 10		Equivalent
10.1		CSA N293-07 : Clause 10.1		Equivalent
10.1.1	Fire response capability commensurate with fire hazards shall be provided for the protected area and the buildings external to the protected area that are under the scope of this Standard for the life cycle of the plant.	CSA N293-07 : Clause 10.1.1 Fire response capability commensurate with fire hazards shall be provided for the protected area and the buildings external to the protected area that are under the scope of this Standard for the life cycle of the plant.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
10.1.2	Fire response capability shall include (a) an industrial fire brigade; (b) a response organization to provide overall control of fires; (c) trained staff who are knowledgeable in the reporting of fires; and (d) trained staff who are knowledgeable in the response to fires (e.g., evacuation procedures).	CSA N293-07 : Clause 10.1.2 Fire response capability shall include (a) an industrial fire brigade; (b) a response organization to provide overall control of fires; (c) trained staff who are knowledgeable in the reporting of fires; and (d) trained staff who are knowledgeable in the response to fires (e.g., evacuation procedures).		Equivalent
10.1.3	The industrial fire brigade required by Clause 10.1.2 shall provide advanced exterior and interior firefighting for the entire life cycle of the plant, with the exception of the encasement phase.	CSA N293-07 : Clause 10.1.3 The industrial fire brigade required by Clause 10.1.2 shall provide advanced exterior and interior firefighting for the entire life cycle of the plant, with the exception of the encasement phase.		Equivalent
10.1.4*	An analysis of postulated fires shall be conducted to determine industrial fire brigade requirements.	CSA N293-07 : Clause 10.1.4* An analysis of postulated fires shall be conducted to determine industrial fire brigade requirements.		Equivalent
10.1.5	After the encasement is in place, the firefighting response required by Clause 10.1.2 may be provided by an off-site municipal fire department. The firefighting response of the municipal fire department shall meet the requirements of NFPA 1710 or NFPA 1720, as applicable, or an equivalent Standard.	CSA N293-07 : Clause 10.1.5 After the encasement is in place, the firefighting response required by Clause 10.1.2 may be provided by an off-site municipal fire department. The firefighting response of the municipal fire department shall meet the requirements of NFPA 1710 or NFPA 1720, as applicable, or an equivalent Standard.		Equivalent
10.2		CSA N293-07 : Clause 10.2		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
10.2.1	The industrial fire brigade shall meet the requirements of NFPA 600 and NFPA 1081 unless otherwise specified in this Standard. The requirement for an industrial fire brigade may be met by having a firefighting organization under contract to the licensee and located on site. The contracted organization shall meet the requirements of NFPA 600 and NFPA 1081.	CSA N293-07 : Clause 10.2.1 The industrial fire brigade shall meet the requirements of NFPA 600 and NFPA 1081 unless otherwise specified in this Standard. The requirement for an industrial fire brigade may be met by having a firefighting organization under contract to the licensee and located on site. The contracted organization shall meet the requirements of NFPA 600 and NFPA 1081.		Equivalent
10.2.2*	Industrial fire brigade members shall have no other plant duties that prevent immediate response to a fire.	CSA N293-07 : Clause 10.2.2 Industrial fire brigade members shall have no other plant duties that prevent immediate response to a fire.		Equivalent
10.2.3	The industrial fire brigade shall have sufficient personnel and equipment to protect safety-related plant areas.	CSA N293-07 : Clause 10.2.3 The industrial fire brigade shall have sufficient personnel and equipment to protect safety-related plant areas.		Equivalent
10.2.4	In the event of a fire, the industrial fire brigade leader shall inform the operations controlling authority (OCA) (i.e., the shift manager or shift supervisor) of the fire situation, firefighting actions, and fire progression. All firefighting operations shall be under the authority of the OCA. Decisions affecting plant safety shall be made by the OCA in consultation with the industrial fire brigade leader.	CSA N293-07 : Clause 10.2.4 In the event of a fire, the industrial fire brigade leader shall inform the operations controlling authority (OCA) (i.e., the shift manager or shift supervisor) of the fire situation, firefighting actions, and fire progression. All firefighting operations shall be under the authority of the OCA. Decisions affecting plant safety shall be made by the OCA in consultation with the industrial fire brigade leader.		Equivalent
10.3		CSA N293-07 : Clause 10.3		Equivalent
10.3.1	The plant shall develop and maintain pre-fire plans. Pre-fire plans shall be available to the industrial fire brigade and to the OCA.	CSA N293-07 : Clause 10.3.1 The plant shall develop and maintain pre-fire plans. Pre-fire plans shall be available to the industrial fire brigade and to the OCA.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
10.3.2	Pre-fire plans shall, as a minimum, detail the following: (a) radiological hazards; (b) chemical hazards; (c) fire hazards; (d) firefighting equipment; (e) significant SSCs of nuclear safety; (f) firefighting guidelines; (g) fire protection water supply information; and (h) electrical hazards.	CSA N293-07 : Clause 10.3.2 Pre-fire plans shall, as a minimum, detail the following: (a) radiological hazards; (b) chemical hazards; (c) fire hazards; (d) firefighting equipment; (e) significant components of nuclear safety; (f) firefighting guidelines; (g) fire protection water supply information; and (h) electrical hazards.		Equivalent
10.3.3*	Pre-fire plans shall be reviewed and updated as necessary, including when changes are made to the FPA.	CSA N293-07 : Clause 10.3.3* Pre-fire plans shall be reviewed and updated as necessary, including when changes are made to the FHA.	The N293-07 Clause 10.3.3 reference to the FHA is more generally replaced by the N293-12 Clause 10.3.3 reference to the FPA.	Equivalent
10.4		CSA N293-07 : Clause 10.4		Equivalent
10.4.1*	All industrial fire brigade members shall meet the medical fitness requirement for using a self-contained breathing apparatus (SCBA), in accordance with CAN/CSA-Z94.4.	CSA N293-07 : Clause 10.4.1 All industrial fire brigade members shall meet the medical fitness requirement for using a self-contained breathing apparatus (SCBA), in accordance with CAN/CSA-Z94.4.		Equivalent
10.4.2	All industrial fire brigade members shall receive training in plant design, including plant layout, major systems, and nuclear safety features, at levels appropriate for their specific response roles.	CSA N293-07 : Clause 10.4.2 All industrial fire brigade members shall receive training in CANDU plant design, including plant layout, major systems, and nuclear safety features, at levels appropriate for their specific response roles.	N293-07 Clause 10.4.2 reference to training in CANDU plant design is generalized in N293-1207 Clause 10.4.2 reference to training in plant design	Equivalent
10.4.3	All industrial fire brigade members shall receive radiation protection training, including the escorting of off-site mutual aid, at levels appropriate for their specific response roles.	CSA N293-07 : Clause 10.4.3 All industrial fire brigade members shall receive radiation protection training, including the escorting of off-site mutual aid, at levels appropriate for their specific response roles.		Equivalent
10.5		CSA N293-07 : Clause 10.5		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
10.5.1	An incident management system that includes the ability to activate the emergency response organization shall be implemented for large fires. Note: An emergency response organization is an appointed group established to activate a response to a major incident.	CSA N293-07 : Clause 10.5.1 An incident management system that includes the ability to activate the emergency response organization shall be implemented for large fires. Note: An emergency response organization is an appointed group established to activate a response to a major incident.		Equivalent
10.5.2	Where mutual aid agreements are entered into with local public fire departments or other private fire brigades, the agreement shall be documented.	CSA N293-07 : Clause 10.5.2 Where mutual aid agreements are entered into with local public fire departments or other private fire brigades, the agreement shall be documented.		Equivalent
10.5.3	Drills that test plant fire response capability shall be run at least once per year and shall use scenarios that test fire response and mutual aid activation.	CSA N293-07 : Clause 10.5.3 Drills that test plant fire response capability shall be run at least once per year and shall use scenarios that test fire response and mutual aid activation.		Equivalent
10.6		CSA N293-07 : Clause 10.6		Equivalent
10.6.1	The industrial fire brigade shall be equipped with an intelligible two-way communication system. Off-site firefighters shall have access to this communication system in order to communicate with the industrial fire brigade while on site.	CSA N293-07 : Clause 10.6.1 The industrial fire brigade shall be equipped with an intelligible two-way communication system. Off-site firefighters shall have access to this communication system in order to communicate with the industrial fire brigade while on site.		Equivalent
10.6.2*	Communications during drills and incidents shall be recorded.	CSA N293-07 : Clause 10.6.2* Communications during drills and incidents shall be recorded.		Equivalent
10.6.3	The industrial fire brigade shall be able to communicate with security personnel.	CSA N293-07 : Clause 10.6.3 The industrial fire brigade shall be able to communicate with security personnel.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
10.6.4	The industrial fire brigade and the OCA shall be able to communicate with each other during the response to a fire.	CSA N293-07 : Clause 10.6.4 The industrial fire brigade and the OCA shall be able to communicate with each other during the response to a fire.		Equivalent
10.7		CSA N293-07 : Clause 10.7		Equivalent
10.7.1	Protective clothing, respiratory protective equipment, radiation monitoring equipment, personal dosimeters, and fire equipment such as hoses, nozzles, and fire extinguishers shall be provided to the industrial fire brigade. This equipment shall be in accordance with all applicable Standards.	CSA N293-07 : Clause 10.7.1 Protective clothing, respiratory protective equipment, radiation monitoring equipment, personal dosimeters, and fire equipment such as hoses, nozzles, and fire extinguishers shall be provided to the industrial fire brigade. This equipment shall be in accordance with all applicable Standards.		Equivalent
10.7.2	Personal protective clothing and equipment shall be in accordance with the requirements of NFPA 600 and NFPA 1081, including the Standards referenced therein, shall apply.	CSA N293-07 : Clause 10.7.2 Personal protective clothing and equipment shall be in accordance with Canadian Standards. Where Canadian Standards are not available, the requirements of NFPA 600 and NFPA 1081, including the Standards referenced therein, shall apply.		Equivalent
10.7.3	All personal protective clothing and equipment shall be checked at the beginning of each shift to ensure it is functional and in a state of readiness.	CSA N293-07 : Clause 10.7.3 All personal protective clothing and equipment shall be checked at the beginning of each shift to ensure it is functional and in a state of readiness.		Equivalent
10.7.4	Personal protective clothing and equipment shall be maintained in accordance with manufacturer's instructions or applicable standards.	CSA N293-07 : Clause 10.7.4 Personal protective clothing and equipment shall be maintained in accordance with manufacturer instructions or applicable standards.		Equivalent
10.7.5	The number of SCBA bottles and/or SCBA refilling capability shall be sufficient to ensure that the industrial fire brigade is adequately supplied during firefighting operations.	CSA N293-07 : Clause 10.7.5 The number of SCBA bottles and/or SCBA refilling capability shall be sufficient to ensure that the industrial fire brigade is adequately supplied during firefighting operations.		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
10.7.6	Off-site fire equipment, where needed, shall be compatible with on-site equipment or shall be equipped with adapters to ensure compatibility.	CSA N293-07 : Clause 10.7.6 Off-site fire equipment, where needed, shall be compatible with on-site equipment or shall be equipped with adapters to ensure compatibility.		Equivalent
10.8		CSA N293-07 : Clause 10.8		Equivalent
10.8.1	The industrial fire brigade minimum performance requirements of Clause 10.8 are in addition to the other performance requirements specified in Clauses 10.1 to 10.7.	CSA N293-07 : Clause 10.8.1 The industrial fire brigade minimum performance requirements of Clause 10.8 are in addition to the other performance requirements specified in Clauses 10.1 to 10.7.		Equivalent
10.8.2*	The industrial fire brigade shall be capable of (a) assembling within 2 min of an emergency response tone being sounded; (b) donning turnout gear within 1 min upon tasking; and (c) donning and activating an SCBA unit within 1 min upon tasking.	CSA N293-07 : Clause 10.8.2 The industrial fire brigade shall be capable of (a) assembling within 2 min of an emergency response tone being sounded; (b) donning turnout gear within 1 min upon tasking; and (c) donning and activating an SCBA unit within 1 min upon tasking.		Equivalent
10.8.3*	During fire responses, the industrial fire brigade shall be capable of (a) establishing an incident command post within 10 min of notification of an emergency; (b) providing size-up information to incident command within 12 min of notification of an emergency; and (c) performing effective and sustained intervention through implementation of the fire attack plan (developed by incident command) within 15 min of being notified of a fire incident.	CSA N293-07 : Clause 10.8.3* During fire responses, the industrial fire brigade shall be capable of (a) establishing an incident command post within 10 min of notification of an emergency; (b) providing size-up information to incident command within 12 min of notification of an emergency; and (c) performing effective and sustained intervention through implementation of the fire attack plan (developed by incident command) within 15 min of being notified of a fire incident.		Equivalent
10.8.4	The capabilities required by Clauses 10.8.2 and 10.8.3 shall be evaluated by qualified persons.	CSA N293-07 : Clause 10.8.4 The capabilities required by Clauses 10.8.2 and 10.8.3 shall be evaluated by qualified persons		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
11		CSA N293-07 : Clause 11	N293-12 clause 11 and its sub-clauses have requirements not covered in N293-07 clause 11, as the scope is now Fire Protection Assessments, which cover the FSSAs covered in N293-07 clause 11, plus Code Compliance Reviews (CCRs) and Fire Hazard Assessments (FHAs).	Different
11.1*	Clause 11 specifies requirements for the preparation of fire protection assessments to meet the fire protection goals, objectives, and criteria specified in Clause 5. See Annex B for detailed guidance.	CSA N293-07 : Clause 11.1.1 Clause 11 specifies requirements for the preparation of a fire safe shutdown analysis (FSSA) for plants. See Annex B for guidance on the methods of conducting an FSSA. CSA N293-07 : Clause 11.1*	N293-07 Clause 11.1.1 notes that Clause 11 specifies requirements for preparation of an FSSA only, while N293-12 Clause 11.1 notes that Clause 11 specifies requirements for FPA, ie. FSSAs, CCRs and FHAs.	Different
11.2		CSA N293-07 : Clause 11.2	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different
11.2.1*	The fire protection assessments shall be initiated early in the design of new plants and updated when the plant design is finalized.	CSA N293-07 : Clause 11.2.1* The FSSA shall be initiated early in the design of new plants and updated before the initial loading of fuel into the reactor.	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different
11.2.2*	The fire protection assessments shall be updated as necessary to reflect plant modifications, significant changes in fire hazards, operating experience, and operational changes.	CSA N293-07 : Clause 11.2.2* Proposed plant modifications and operational changes within an operating plant, including changes to fire hazards or a change in the level of fire protection, shall be reviewed for potential impacts to fire safe shutdown or the protection of radioactive materials outside the reactor. Where permanent modifications have an impact on these objectives, the FSSA shall be revised to reflect the modifications and shall demonstrate that the nuclear safety objectives specified in Clause 5.4.1 continue to be met.	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
11.2.3	The fire protection assessments for an operating plant shall be revised or reaffirmed at least once every five years.	CSA N293-07 : Clause 11.2.3 The FSSA for an operating plant is a living document and shall be updated or confirmed at least once every five years.	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different
11.3		CSA N293-07 : Clause 11.5	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different
11.3.1*	The fire protection assessments shall cover all locations within the protected area and areas external to the protected area that are under the scope of this Standard.	CSA N293-07 : Clause 11.5.1* To ensure that all fire hazards that have the potential for affecting nuclear safety are identified, the FSSA shall cover all locations within the protected area and areas external to the protected area that are under the scope of this Standard, including non-nuclear facilities and exposures.	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different
11.3.2*	The fire protection assessments shall cover fires occurring during all operational modes, including power operation, shutdown or start-up, and outages.	CSA N293-07 : Clause 11.5.2* The FSSA shall cover fires occurring during all operational modes, including power operation, shutdown or start-up, and outages.	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different
11.4*	The defence-in-depth principle specified in Clause 5.3 requires that multiple, independent fire protection measures be used to achieve a high degree of assurance that nuclear safety will be maintained at all times. The defence-in-depth principle shall be used in the fire protection assessments to help determine the fire protection measures needed to ensure the achievement of the nuclear safety objectives specified in Clause 5.4.1.	CSA N293-07 : Clause 11.6* The defence-in-depth principle specified in Clause 5.3 requires that multiple, independent fire protection measures be used to achieve a high degree of assurance that nuclear safety will be maintained at all times. The defence-in-depth principle shall be used in the FSSA evaluation to help determine the fire protection measures needed to ensure the achievement of the nuclear safety objectives specified in Clause 5.4.1.	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different
11.5	Assumptions used and not specified in Clause 11.5, Items (a) to (f), shall be clearly stated and justified in the documentation. When assessing fire hazards and consequences of fires, the following are considered acceptable assumptions:	CSA N293-07 : Clause 11.8 CSA N293-07 : Clause 11.8.1 When assessing fire hazards and consequences of fires, the following are considered acceptable assumptions: (a) Fires need not be postulated coincident with independent, low-frequency events or accidents in the		Equivalent

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
	(a) Fires need not be postulated coincident with independent, low-frequency events or accidents in the plant. (b) Two or more simultaneous, independent fires in a plant or adjacent plant units need not be postulated. (c) In a fire safe shutdown analysis, failure of a single component need not be postulated coincident with failures caused by fire. (d) Credit may be given to equipment or components that result in fail-safe conditions after damage by fire or fire suppression action (e.g., loss of power to shut-off rods resulting in reactor trip), provided that the fail-safe characteristics of the equipment or component are individually assessed against the failure modes induced by the fire or fire suppression action. (e) Manual action by operators may be credited toward the accomplishment of the nuclear safety objectives (provided that the necessary conditions for correct and timely actions have been identified and justified). (f) Credit may be given for repair or replacement of components or circuits that are damaged or disabled by fire, provided that the following conditions are met: (i) Such credits are kept to a minimum. (ii) Credit is given only for restoring long-term functions after the reactor has been shutdown, cooled, and depressurized. (iii) It is demonstrated that all necessary work can be completed before the component or circuit is required to act. (iv) Procedures and training are provided for the repair or replacement work. (v) Necessary components, cables, and parts are available on site.	plant. (b) Two or more simultaneous, independent fires in a plant or adjacent plant units need not be postulated. (c) A single failure in the fire safe shutdown systems need not be postulated coincident with failures caused by fire. (d) Credit may be given to equipment or components that result in fail-safe conditions after damage by fire or fire suppression action (e.g., loss of power to shut-off rods resulting in reactor trip), provided that the fail-safe qualities of the equipment or component are individually assessed against the failure modes induced by the fire or fire suppression action. (e) Manual action by operators may be credited toward the accomplishment of the fire safe shutdown functions, provided that the necessary conditions for correct and timely actions have been identified and justified. (f) Credit may be given for repair or replacement of components or circuits that are damaged or disabled by fire, provided that the following conditions are met: (i) such credits are kept to a minimum; (ii) credit is given only for restoring long-term functions after the reactor has been shutdown, cooled, and depressurized; (iii) it is demonstrated that all necessary work can be completed before the component or circuit is required to act; (iv) procedures and training are provided for the repair or replacement work; and (v) necessary components, cables, and parts are available on site.		

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
11.6	Limitations and uncertainties concerning the data and methods used shall be identified. The assessment and analysis shall demonstrate that these limitations and uncertainties are adequately addressed (e.g., by the use of suitable safety margins). Note: Appropriate sensitivity analysis may be necessary to demonstrate suitable safety margins in light of uncertainties in data and methods.	CSA N293-07 : Clause 11.9 Limitations and uncertainties concerning the data and methods used in the FSSA shall be identified. The FSSA shall demonstrate that these limitations and uncertainties are adequately addressed (e.g., by the use of suitable safety margins).	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different
11.7*	The following documentation is required as a minimum: (a) the SSCs required to perform the nuclear safety objectives defined in Clause 5.4 and their location; (b) the general usage of the fire compartment or zone, including the major equipment present; (c) the inventory and configuration of combustible materials in each fire zone; (d) postulation of the design basis fires in each fire zone and assessment of resulting damage to plant SSCs; (e) postulation of the failures, and potential failure modes, of equipment in applicable fire zone and assessment of resulting impacts to plant fire safe shutdown; (f) the technical basis of each step in demonstrating the achievement of safety objectives of the standard; (g) fire mitigation measures, including: (i) fire detection; (ii) automatic and manual suppression; (iii) fire separations; (iv) spatial separations; and (v) smoke control; (h) verification that the nuclear safety performance criteria specified in Clause 5.4.2 have been met, or additional fire protection measures that are required;	CSA N293-07 : Clause 11.4* The FSSA shall provide documentation of the following: (a) the SSCs required to perform the nuclear safety functions defined in Clause 5.4 (otherwise known as fire safe shutdown systems), as well as their location; (b) the inventory and configuration of in situ combustible materials in each fire zone, including transient combustibles that could be present; (c) postulation of the design basis fires in each fire zone and assessment of resulting damage to plant SSCs. Documentation shall include the basis of each step in the assessment from fire initiation to fire growth, as well as equipment damage, failures, and consequences on nuclear safety; (d) fire detection measures as well as automatic and manual suppression measures; (e) other fire mitigation measures such as fire separations, spatial separations, and smoke control measures; (f) verification that the fire safe shutdown criteria have been met by ensuring that at least one success path remains available to perform the nuclear safety performance criteria specified in Clause 5.4.2 or, alternatively, identification of the additional fire protection measures that are required; (g) verification that the criteria for the protection of radioactive materials outside the reactor, as defined in	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different

Clause	Clause Text	Associated Clause(s)	Assessment	Evaluation
	(i) verification that the criteria for the protection of radioactive materials outside the reactor, as defined in Clause 5.4.3, have been met, or additional fire protection measures that are required; (j) compliance with the applicable requirements of this Standard and referenced documents; and (k) assessment of effectiveness, appropriateness, and reliability of the fire protection measures in meeting the goals and objectives of this Standard.	Clause 5.4.3, have been met or, alternatively, identification of the additional fire protection measures that are required; and (h) the general usage of the fire compartment or zone, including the major equipment present.		
11.8		CSA N293-07 : Clause 11.7		Equivalent
11.8.1	The preparation and review of the fire protection assessments required by this Standard shall comply with the quality assurance requirements of CSA N286. The CSA N286 requirements shall also apply to any revisions.	CSA N293-07 : Clause 11.7.1 The preparation and review of the FSSA as part of the design process shall comply with the quality assurance requirements of CSA N286. The CSA N286 requirements shall also apply to any revision to the FSSA of an operating plant.	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different
11.8.2	Fire protection assessments performed to demonstrate compliance to this Standard shall be auditable.			New Requirement
11.8.3*	The fire protection assessments shall be prepared by personnel with knowledge of fire protection, plant design, and nuclear safety. This qualification of personnel applies to the preparation of the original document and to periodic updating of the assessment.	CSA N293-07 : Clause 11.7.2* The FSSA shall be prepared by personnel with knowledge of fire protection, plant system design, and nuclear safety. The FSSA shall be subject to a peer review by persons having at least the same level of knowledge as those responsible for its preparation. This qualification of personnel applies to the preparation of the original document and to periodic updating of the assessment.	N293-07 scope is FSSA only, while N293-12 scope is FPA (FSSA, CCR and FHA)	Different