FORM-14159 R000*

Periodic Safety Review - Final Document Review Traveler

Bruce Power™

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Accepted for use at Bruce Power by:	**Signature:**	**Date**
Name: Frank Saunders Title: Vice President, Nuclear Oversight & Regulatory Affairs		29 SEP 2016

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Reviewed By:

Name	Title	Department	Signature	Date
Lovell Gilbert	Section Manager	Deterministic Safety Analysis	electronic acceptance	13Sep2016
Wayne Bruce (RegC AR 28563005.04)	Section Manager	Emergency & Protection Services	electronic acceptance	13Sep2016

Recommended for Use By:

Name	Title	Department	Signature	Date
Dean Burleigh (RegC AR 28563005)	Department Manager	Emergency & Protection Services		26 SEP 2016

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candesco
Division of Kinectrics Inc.

NK29-SFR-09701-00013

Title: Safety Factor 13 - Emergency Planning

File: K-421231-00213-R00

A Report Submitted to Bruce Power

September 20, 2016

Issue R00D0	**Reason for Issue:** For harmonization				
	Author: S. Petrella	Verifier:	Reviewer:	Approver:	Date: May 5, 2016
Issue R00D1	**Reason for Issue:** For internal review				
	Author: S. Petrella	Verifier:	Reviewer: L. Watt G. Archinoff	Approver:	Date: May 6, 2016
Issue R00D2	**Reason for Issue:** For Bruce Power review				
	Author: S. Petrella	Verifier: G. Buckley	Reviewer: L. Watt G. Archinoff	Approver:	Date: June 13, 2016
Issue R00D3	**Reason for Issue:** Addresses Bruce Power review comments and internal verification comments.				
	Author: S. Petrella	Verifier: G. Buckley	Reviewer: L. Watt G. Archinoff	Approver:	Date: August 24, 2016

candesco Division of Kinectrics Inc.	Rev Date: September 20, 2016	Status: Issued
	Subject: Safety Factor 13 - Emergency Planning	File: K-421231-00213-R00

Issue R00	**Reason for Issue:** For use				
	Author: S. Petrella	Verifier: G. Buckley	Reviewer: L. Watt G. Archinoff	Approver: L. Watt	Date: Sept 20, 2016
Document Classification: Report			Security Classification: Client Proprietary		

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Acronyms and Abbreviations

AIM	Abnormal Incidents Manual
AOO	Anticipated Operational Occurrence
AR	Action Request
BDBA	Beyond Design Basis Accident
BEST	Bruce Emergency Services Team (not in current use)
BP	Bruce Power
BPNERP	Bruce Power Nuclear Emergency Response Plan
BSRV	Boiler Safety Relief Valve
CESC	Corporate Emergency Support Centre
CFAM	Corporate Functional Area Manager
CMLF	Central Maintenance and Laundry Facility
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
DBA	Design Basis Accident
EMC	Emergency Management Centre
EME(G)	Emergency Mitigating Equipment (Guidance)
EOC	Emergency Operations Centre
EP	Emergency Plan
EPG	Emergency Power Generator
EPS	Emergency and Protective Services
ERO	Emergency Response Organization
ERP	Emergency Response Plan
ERT	Emergency Response Team
ESA	Emergency Shift Assistant
ESM	Emergency Services Maintainer
FAI	Fukushima Action Item
FASA	Focus Area Self Assessment
GAR	Global Assessment Report
GSR	General Safety Requirement

HQEOC	Headquarters Emergency Operations Centre
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IFB	Irradiated Fuel Bay
IIP	Integrated Implementation Plan
IMS	Incident Management System
ISR	Integrated Safety Review
LCH	Licence Conditions Handbook
LTEP	Long Term Energy Plan
MART	Mutual Assist Response Team
MCR	Main Control Room
NEO	Nuclear Emergency Organization
NERP	Nuclear Emergency Response Plan
NPP	Nuclear Power Plant
NSCA	Nuclear Safety and Control Act
OFI	Opportunity for Improvement
OPEX	Operating Experience
OSART	Operational Safety Review Team
PARs	Passive Autocatalytic Recombiners
PBX	Private Branch Exchange
PEOC	Provincial Emergency Operations Centre
PI	Performance Indicator
PNERP	Provincial Nuclear Emergency Response Plan
PRA	Probabilistic Risk Assessment
PROL	Power Reactor Operating Licence
PSR	Periodic Safety Review
SAM(G)	Severe Accident Management (Guidance)
SAT	Systematic Approach to Training
SBR	Safety Basis Report
SCA	Safety and Control Area
SCR	Station Condition Record

SFR	Safety Factor Report
SMC	Site Management Centre
SME	Subject Matter Expert
VSAT	Very Small Aperture Terminal

1. Objective and Description

Bruce Power (BP), as an essential part of its operating strategy, is planning to continue operation of Bruce B as part of its contribution to the Long Term Energy Plan (LTEP) (http://www.energy.gov.on.ca/en/ltep/). Bruce Power has developed integrated plant life management plans in support of operation to 247,000 Equivalent Full Power Hours in accordance with the Bruce Power Reactor Operating Licence (PROL) [1] and Licence Conditions Handbook (LCH) [2]. A more intensive Asset Management program is under development, which includes a Major Component Replacement (MCR) approach to replacing 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 regular maintenance outage will be scheduled concurrently with MCR. In accordance with Licence Condition 15.2 of the PROL [1], Bruce Power is required to inform the Canadian Nuclear Safety Commission (CNSC) of any plan to refurbish a reactor or replace a major component at the nuclear facilities, and Bruce Power shall:

(i) Prepare and conduct a periodic safety review;

(ii) Implement and maintain a return-to-service plan; and

(iii) Provide periodic updates on progress and proposed changes.

The fifteen reports prepared as part of the Periodic Safety Review (PSR), including this Safety Factor Report (SFR), are intended to satisfy Licence Condition 15.2 (i) as a comprehensive evaluation of the design, condition and operation of the nuclear power plant (NPP). In accordance with Regulatory Document REGDOC-2.3.3 [3], a PSR is an effective way to obtain an overall view of actual plant safety and the quality of safety documentation and determine reasonable and practicable improvements to ensure safety until the next PSR.

Bruce Power has well-established PSR requirements and processes for the conduct of a PSR for the purpose of life-cycle management, which are documented in the procedure Periodic Safety Reviews [4]. This procedure, in combination with the Bruce B Periodic Safety Review Basis Document [5], governs the conduct of the PSR and facilitates its regulatory review to ensure that Bruce Power and the CNSC have the same expectations for scope, methodology and outcome of the PSR.

This PSR supersedes the Bruce B portion of the interim PSR that was conducted in support of the ongoing operation of the Bruce A and Bruce B units until 2019 [6]. Per REGDOC-2.3.3 [3], subsequent PSRs will focus on changes in requirements, facility conditions, operating experience and new information rather than repeating activities of previous reviews.

1.1. Objective

The overall objectives of the Bruce B PSR are to conduct a review of Bruce B against modern codes and standards and international safety expectations, and to provide input to a practicable

set of improvements to be conducted during the MCR in Units 5 to 8, and during asset management activities to support ongoing operation of all four units, as well as U0B, that will enhance safety to support long term operation. 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.

The specific objective of the review of this Safety Factor is to determine whether the operating organization has adequate plans, staff, facilities and equipment for dealing with emergencies and whether the operating organization's arrangements have been adequately coordinated with local and national systems and are regularly exercised.

1.2. Description

The review is conducted in accordance with the Bruce B PSR Basis Document [5], which states that the review tasks are as follows:

1. An overall review will be performed to check that emergency planning at the plant continues to be satisfactory and to check that emergency plans (EPs) are maintained in accordance with current safety analyses, accident mitigation studies and good practices.
2. It will be verified if the operating organization has given adequate consideration to significant changes at the site of the nuclear power plant and in its use, organizational changes at the plant, changes in the maintenance and storage of emergency equipment and developments around the site that could influence emergency planning.
3. Additionally,
    a. Evaluate the adequacy of on-site equipment and facilities for emergencies;
    b. Evaluate the adequacy of on-site technical and operational support centres;
    c. Evaluate the efficiency of communications in the event of an emergency, in particular the interaction with organizations outside the plant;
    d. Evaluate the content and effectiveness of emergency training and exercises and check records of experience from such exercises;
    e. Evaluate arrangements for the regular review and updating of emergency plans and procedures;
    f. Examine changes in the maintenance and storage of emergency equipment; and
    g. Evaluate the effects of any recent residential and industrial developments around the site.

As required by the PSR Basis Document, preparation of this Safety Factor Report included an assessment of the review tasks to determine if modifications were appropriate. Any changes to the review tasks described in this section are documented and justified in Section 5.

2. Methodology of Review

As discussed in the Bruce B PSR Basis Document [5], the methodology for a PSR should include making use of safety reviews that have already been performed for other reasons. Accordingly, the Bruce B PSR 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] [10];
- Proposed refurbishments of Bruce Units 3 and 4 (circa 2008) [11] [12] [13] [14] [15];
- Safety Basis Report (SBR) and PSR for Bruce Units 1 to 8 (2013) [6]; and
- Bruce A Integrated Safety Review (ISR) to enhance safety and support long term operation (2015) [16] [17].

These reviews covered many, if not all, of the same Safety Factors that are reviewed in the current PSR. A full chronology of Bruce Power safety reviews up to 2013 is provided in Appendix F of [18].

The Bruce B PSR Safety Factor review process comprises the following steps:

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 PSR Basis Document [5] 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 PSR 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 the assessor confirming that the assessment type identified in Appendix C of the Bruce B PSR Basis Document [5] for each of the codes, standards and guidance documents selected for this factor is appropriate based on the guidance provided. The PSR 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 PSR Basis Document.

4. **Perform gap assessment against codes and standards:** This step comprises the actual assessment of the Bruce Power programs and the Bruce B plant against the identified codes and standards. In general, this involves determining from available design or programmatic documentation whether the plant or program 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 the 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 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. The results of this step are documented in Section 5 of each SFR.
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 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 B 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. Table C-1 of the Bruce B PSR Basis Document [5] identifies the codes, standards and guides that are relevant to this PSR. Modern revisions of some codes and standards listed in Table C-1 of the PSR Basis Document [5] have been identified in the licence renewal application and supplementary submissions for the current PROL [19] [20] [21]. Codes, standards and guides issued after the freeze date of December 31, 2015 were not considered in the review [5].

3.1. Acts and Regulations

The *Nuclear Safety and Control Act* (NSCA) [22] establishes the Canadian Nuclear Safety Commission and its authority to regulate nuclear activities in Canada. Bruce Power has a process to ensure compliance with the NSCA [22] 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 emergency planning that are referenced in the PROL [1] and LCH [2], and noted in Table C-1 of the Bruce B PSR Basis Document [5], are identified in Table 1. The edition dates referenced in the third column of the table are the modern versions used for comparison.

The Bruce Nuclear Generating Stations A and B operate under the authority of the PROL issued by the CNSC [1]. Licence Condition 10.1, Emergency Management and Fire Protection, is directly relevant to this review. This condition requires:

> "The licensee shall implement and maintain an emergency preparedness program and conduct emergency exercises".

The PROL Licence Conditions Handbook (LCH) [2] Section 10.1 references REGDOC 2.10.1 [23] for compliance verification criteria of Bruce Power's emergency preparedness program with an effective date of December 31, 2018. The LCH outlines an implementation strategy for REGDOC-2.10.1, and requires Bruce Power to perform a gap analysis and submit a transition plan by June 30, 2015. It also identifies Bruce Power's Nuclear Emergency Response Plan, BP-PLAN-00001 [24] as subject to document version control (i.e., changes to Bruce Power's Nuclear Emergency Response Plan require notification to the Commission, or a person authorized by the Commission, prior to implementation). In addition it requires written, but not prior, notification of changes to Bruce Power's Emergency Management Program [25]. The

LCH also provides recommendations and guidance that the licensee provide emergency communications outlining what surrounding community residents need to know and do before, during and after a nuclear emergency.

In addition, Section 3.1 of the LCH [2] references CNSC REGDOC-2.3.2, Accident Management: Severe Accident Management Programs for Nuclear Reactors, 2013 revision [26], for compliance verification criteria of Bruce Power's operations program with an effective date of September 30, 2015, and includes a description of Bruce Power's transition plan.

The list of codes and standards related to emergency planning that are referenced in the Bruce Power PROL [1] and LCH [2] are identified in Table 1. 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 and B PROL and LCH

Document Number	Document Title	Modern Version used for PSR Comparison	Type of Review
CNSC REGDOC-2.3.3	Periodic Safety Reviews	[3]	NA
CNSC REGDOC-2.10.1 Version 2 (2014)	Emergency Management and Fire Protection: Nuclear Emergency Preparedness and Response	[23]	CBC
CNSC REGDOC-2.3.2 (2013)	Accident Management: Severe Accident Management Programs for Nuclear Reactors	Version 2 (2015) [27]	CBC
CNSC RD/GD-99.3 (2012)	Public Information and Disclosure	[28]	NA
CSA N286-05 [29]	Management System Requirements for Nuclear Power Plants	CSA N286-12 [30]	NA
Assessment type: **NA**: Not Assessed; **CBC**: Clause-by-Clause; **PCBC**: Partial Clause-by-Clause; **CTC**: Code-to-Code; **HL**: High Level; **2SF**: Assessment performed in another SFR; **CV**: Confirm Validity of Previous Assessments			

CNSC REGDOC-2.3.3: This PSR is being conducted in accordance with CNSC REGDOC-2.3.3 per Licence Condition 15.2 (i) [1], and associated compliance verification criteria [2]. Therefore, REGDOC-2.3.3 is not reviewed further in this document.

CNSC REGDOC-2.10.1: Table C-1 of the PSR Basis Document [5] calls for a clause-by-clause assessment of CNSC REGDOC-2.10.1. As noted above, the LCH requires that, as part of the emergency preparedness program, the licensee is to come into compliance with REGDOC-2.10.1 and has submitted a transition plan in accordance with the LCH. While this regulatory document is included in the current licence, a clause-by-clause assessment is considered appropriate due to the newness of this standard and to maintain continuity with the recently prepared SF13 review for Bruce A [17].

CNSC REGDOC-2.3.2: CNSC REGDOC-2.3.2, Accident Management, Version 2 [27], which supersedes REGDOC-2.3.2, Severe Accident Management Programs for Nuclear Reactors, published in September 2014, sets out the CNSC's requirements and guidance related to the development, implementation and validation of integrated accident management programs (IAMPs) for reactor facilities encompassing anticipated operational occurrences (AOOs), design basis accidents (DBAs) and beyond design basis accidents (BDBAs), including severe accidents. Accident management, which deals with preventing the escalation of an accident and mitigating its consequences, supports emergency preparedness and response, by mitigating the effects of an off-site release. Per Table C-1 of the PSR Basis Document [5], and per the rationale provided for REGDOC-2.10.1 above, a clause-by-clause of CNSC REGDOC-2.3.2 Version 2 is considered appropriate.

CNSC RD/GD-99.3: Table C-1 of the PSR Basis Document [5] states that RD/GD-99.3 Public Information and Disclosure [28], which establishes regulatory requirements for public information and disclosure for licensees, is included in the current licence and accordingly no further assessment of RD/GD-99.3 requirements is performed for this PSR. Moreover, the direct link to emergency management has been removed in the current LCH [2].

CSA N286-12: CSA N286-05 is noted in the PROL (Licence Condition 1.1 [1]). Per the LCH [2], an implementation strategy for the 2012 version is in progress to be submitted to the CNSC by the end of January 2016. 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" [31].

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 current licensing period [32]. 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 [33]. Bruce Power further stated CSA N286-12 does not establish any significant or immediate new safety requirements that would merit a more accelerated implementation. The gap analysis and the resulting transition plan were submitted to the CNSC [34]. Per [34], the major milestones of the transition plan to N286-12 are as follows:

- 22 January 2016: Discuss all the regulatory actions and the transition plan at the (Corporate Functional Area Manager) CFAM meeting

- 31 December 2016: Revision of CFAM Program Document(s) [with LCH notification requirements to the CNSC] to comply with CSA N286-12 requirements completed.
- 31 March 2017: Revision of CFAM Program Document(s) [that do not have LCH notification requirements to the CNSC] to comply with CSA N286-12 requirements completed
- 31 December 2017: Confirmation that that all impacted documents in the program suite comply with the requirements of CSA N286-12
- 15 September 2018: Verification via a Focus Area Self Assessment (FASA) that previously identified transition Gaps to meeting the requirements of CSA N286-12 have been addressed and effectively implemented
- 14 December 2018: issue notification to the CNSC regarding state of CSA N286-12 readiness, and, implementation date

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 and there is a transition plan in effect.

3.3. Regulatory Documents

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

Table 2: Regulatory Documents

Document Number	Document Title	Reference	Type of Review
CNSC P-325 (2006)	Nuclear Emergency Management	[35]	NA
Assessment type: **NA**: Not Assessed; **CBC**: Clause-by-Clause; **PCBC**: Partial Clause-by-Clause; **CTC**: Code-to-Code; **HL**: High Level; **2SF**: Assessment performed in another SFR; **CV**: Confirm Validity of Previous Assessments			

CNSC P-325: Table C-1 of the PSR Basis Document [5] calls for confirming the validity of the previous assessment of Regulatory Policy P-325 [35]. This document describes the guiding principles and direction for CNSC staff activities related to nuclear emergency management. It also describes the organization of the CNSC's Nuclear Emergency Organization (NEO) and the roles and responsibilities of Commission members and CNSC support staff within the NEO. Given P-325 does not impose any specific obligations on licensees, the Policy was not reviewed further.

3.4. CSA Standards

In addition to those identified in the Bruce Power PROL [1] and LCH [2] the Canadian Standards Association (CSA) standards identified in Table C-1 of the PSR Basis Document [5] considered for application to review tasks of this Safety Factor are included in Table 3.

Table 3: CSA Standards

Document Number	Document Title	Reference	Type of Review
CSA N288.2-14	Guidelines for Calculating Radiation Doses to the Public from a Release under Airborne Radioactive Material Under Hypothetical Accident Conditions in Nuclear Reactors	[36]	2SF
CSA N1600-14	General requirements for nuclear emergency management programs	[37]	HL
CSA Z731-03 (R2014)	Emergency Planning for Industry	[38]	NA
Assessment type: **NA**: Not Assessed; **CBC**: Clause-by-Clause; **PCBC**: Partial Clause-by-Clause; **CTC**: Code-to-Code; **HL**: High Level; **2SF**: Assessment performed in another SFR; **CV**: Confirm Validity of Previous Assessments			

CSA N288.2-91: CSA N288.2-14 [36] provides guidelines for calculating radiation doses to the public from a release of airborne radioactive material under hypothetical accident conditions in nuclear reactors. A high level assessment is performed in Safety Factor 5.

CSA N1600: Table C-1 of the PSR Basis Document [5] calls for a high-level assessment of CSA N1600. Given the similarity in scope between CSA N1600 [37] and CNSC REGDOC-2.10.1 [23] and CNSC REGDOC-2.3.2 [27], and the fact that these CNSC REGDOCs are assessed clause-by-clause, a high level assessment was considered to be appropriate. This is provided in Appendix A (Section A.1).

CSA Z731: Table C-1 of the PSR Basis Document [5] calls for confirming the validity of the previous assessment of CSA Z731 [38]. However, CSA N1600 is a new standard specific to nuclear emergency management, which is assessed in this PSR Appendix A (Section A.1). As such, an assessment of CSA Z731 is not required.

3.5. International Standards

The international standards listed in Table 4 were considered for this review.

Table 4: International Standards

Document Number	Document Title	Reference	Type of Review
IAEA SSG-25	Periodic Safety Review For Nuclear Power Plants	[39]	NA
IAEA GSR Part 7	Preparedness and Response for a Nuclear or Radiological Emergency	[40]	HL
Assessment type: **NA**: Not Assessed; **CBC**: Clause-by-Clause; **PCBC**: Partial Clause-by-Clause; **CTC**: Code-to-Code; **HL**: High Level; **2SF**: Assessment performed in another SFR; **CV**: Confirm Validity of Previous Assessments			

IAEA SSG-25: IAEA SSG-25 [39] addresses the periodic safety review of nuclear power plants. Per the PSR Basis Document [5] this PSR is being conducted in accordance with REGDOC-2.3.3. As stated in REGDOC-2.3.3 [3], this regulatory document is consistent with IAEA SSG-25. The combination of IAEA SSG-25 and REGDOC-2.3.3, define the review tasks that should be considered for the Safety Factor Reports. Thus, no assessment is performed specifically on IAEA SSG-25.

IAEA GSR Part 7: Table C-1 of the PSR Basis Document [5] does not refer to International Atomic Energy Agency (IAEA) GSR (General Safety Requirement) Part 7. This document is an update to IAEA GS-R-2, Preparedness and Response for a Nuclear or Radiological Emergency, published in 2002 and which was considered by the CNSC in preparing REGDOC-2.10.1. It is an update that considers experience with emergencies and exercises since the publication of IAEA GS-R-2 in 2002 (including the response to the accident at the Fukushima Daiichi nuclear power plant in Japan in March 2011), and in due consideration of recommendations of the International Commission on Radiological Protection (ICRP). Thus, a high level review of changes that relate to the operating organization is considered appropriate.

3.6. Other Applicable Codes and Standards

The codes and standards discussed in the previous sub-sections have been determined to be sufficient for the completion of the review tasks of this Safety Factor. Accordingly, additional codes and standards are not considered in this Safety Factor Report.

4. Overview of Applicable Bruce B Station Programs and Processes

This section provides a brief overview of the key Bruce Power programs, procedures and practices related to this Safety Factor, as well as the improvements to emergency preparedness made subsequent to the severe accidents initiated at the Fukushima-Daiichi nuclear power plant on March 11, 2011 from a magnitude 9.0 earthquake and subsequent tsunami.

Emergency planning is addressed at the highest level (Level 1) of the hierarchy in the Management System Manual BP-MSM-1 [41]. BP-MSM-1 includes Bruce Power Policy Statements for a number of different programs, including Emergency Management. The policy for Emergency Management (in Appendix A, [41]) states:

> "Bruce Power shall ensure adequate planning and preparation is in place to deal with any emergency situations that could endanger the safety of site staff, impact on the protection of the environment, and/or impact on the safety of members of the public.
>
> Bruce Power shall manage emergencies using an "all hazards" approach, encompassing mitigation, preparedness, response and recovery."

Bruce Power's BP-PROG-08.01 Emergency Management Program (Level 2) [25] defines the fundamental business need, constituent elements, and key responsibilities associated with the emergency management process. The program has been established to meet the general requirements of CSA N286-05[1] [29], Management System Requirements for Nuclear Power Plants, and a suite of implementing documents has been created to meet specific requirements of N286-05 and other statutory, regulatory and licensing requirements and are structured using a Plan-Do-Check-Act cycle. The program also aligns with Canadian Standards Association CSA N1600-14, General Requirements for Nuclear Emergency Management Programs [37]. It follows an Incident Management System (IMS) approach for applying an all-hazards emergency management process to identified threats to employee and public health and safety, environmental safety and to the continuity of Bruce Power's business to ensure a rapid and effective response to events.

The Emergency Management Program is structured using a Plan-Do-Check-Act cycle, encompassing five program elements:

- Prevention,
- Mitigation,
- Preparedness,
- Response,
- Transition to recovery.

The Emergency Management Program is implemented through six Level 3 plans and one Level 3 procedure. The six Level 3 plans are:

[1] Note that the program is currently being transitioned to reflect the requirements of CSA N286-12.

- Bruce Power Nuclear Emergency Response Plan (BP-PLAN-00001) [24];
- Winter Storm Transportation Plan (BP-PLAN-00002) [42];
- Bruce Power Electricity Emergency Plan (BP-PLAN-00003) [43];
- Business Power Recovery Plan (BP-PLAN-00004) [44][2];
- Radioactive Materials Transportation Emergency Response Plan (BP-PLAN-00005) [45]; and;
- Conventional Emergency Management (BP-PLAN-00006) [46].

The Level 3 procedure, used for internal assessments of the program, is:

- Emergency Management Program Performance [47][3].

Other procedures, at Levels 4, or 5 support the above Level 3 plans and procedures. For example, the Level 4 procedure, Emergency Preparedness Drill and Exercises (BP-PROC-00010) [48], describes the procedures for assessing emergency readiness.

The primary aim of the Bruce Power Nuclear Emergency Response Plan [24] is to describe the concepts, structures, roles and processes needed to implement and maintain Bruce Power's radiological emergency response capability. The Nuclear Emergency Response Plan (NERP) applies to all facilities within the Bruce Power Site and focuses on an "all hazards" approach to response requirements. It was developed to support response to design basis accidents that occur at Bruce A or Bruce B which endanger the safety of personnel in the incident station, personnel on-site, members of the public and the environment, but also takes into account requirements to support a sustained response to Beyond Design Basis events, for example a Beyond Design Basis multi-unit event resulting in an extended loss of off-site power for up to 72 hours without assistance. The NERP predominantly deals with releases of radioactive materials from fixed facilities. It takes into account the requirements in G-225, Emergency Planning at Class I Nuclear Facilities and Uranium Mines and Mills [49] and supports the mandate of the Provincial Nuclear Emergency Response Plan (PNERP) to safeguard the public and property. However, the infrastructures that are defined within this plan can be used to support the planning and response to all emergencies at the Bruce Power site.

For those events where accident consequences indicate that the damage is beyond that for design basis accidents, the Emergency Response Organization (ERO) will activate BP-PROC-00659 [50], Severe Accident Management (SAM) to manage the on-site response to a severe accident and thus minimize releases to the environment. This procedure interfaces with BP-PLAN-00001 in order to utilize the structures and processes contained therein.

The Bruce Power Nuclear Emergency Response Plan [24] describes:

- The basis for emergency planning;

[2] Currently issued as "Business Continuity Management Plan". It is identified as "Bruce Power Recovery Plan" in the document hierarchy in BP-PROG-08.01 [25]. Development of recovery plans is identified in the transition plan for REGDOC-2.10.1 [23].
[3] This document is in 'reserve status'. It is to replace SEC-EPP-00007, Emergency Management Programs Assessment.

- The stages of the response to an emergency and the major activities performed during each stage;
- Mutual aid agreements;
- Facilities and equipment;
- Public education;
- Preparedness, maintenance and administration;
- Program assessment; and
- Personnel training and qualifications.

The Bruce Power Nuclear Emergency Response Plan [24] also represents a basis for controlling changes and modifications to the Bruce Power emergency preparedness capability. This plan identifies the Shift Crew emergency staffing requirements associated with conduct of plant operations identified in BP-PROG-12.01 Conduct of Plant Operations [51]. Appendix B of the Nuclear Emergency Response Plan identifies station specific documents that either implement or support the emergency plan.

The Bruce Power Nuclear Emergency Response Plan [24] is submitted to and accepted by the CNSC. It is also referenced in the LCH [2]. This Plan has also been discussed with, agreed to, and rehearsed with the local authorities.

The list of Bruce Power policies, programs and key implementing procedures that are relevant to emergency planning is provided in Table 5[4].

Table 5: Key Implementing Documents

Level 1	Level 2	Level 3	Level 4
BP-MSM-1: Management System Manual [41]	BP-PROG-08.01: Emergency Management Program [25]	BP-PLAN-00001: Bruce Power Nuclear Emergency response Plan [24]	BP-PROC-00011: Emergency Response Organization, Staffing and Availability [52]
			BP-PROC-00845: Emergency Dose Projection Process [53]

[4] Table 5 lists the key governance documents used to support the assessments of the review tasks for this Safety Factor Report. A full set of current sub-tier documents is provided within each current PROG document. In the list of references, the revision number for the governance documents is the key, unambiguous identifier; the date shown is an indicator of when the document was last updated, and is taken either from PassPort, the header field, or the “Master Created” date in the footer.

Level 1	Level 2	Level 3	Level 4
			BP-PROC-00846: Emergency Off-site Radiological Monitoring Process for Airborne Releases of Radioactive Materials [54]
			BP-PROC-00127: Radioactive Liquid Emissions Response Procedure [55]
			BP-ERP-XXXXX: Bruce Power Emergency Response Procedures (various)
			BP-PROC-00659: Severe Accident Management [50]
			BP-PROC-00963: Public Alerting – Off-Site Warning Sirens [56][5]
		BP-PLAN-00004: Bruce Power Recovery Plan [44]	BP-PROC-00317: Crisis Management [57]
		BP-PROC-01029: Emergency Management Program Performance [47]	BP-PROC-00010: Emergency Management Drills and Exercises [48]
	BP-PROG-01.07: Corrective Action [58]	BP-PROC-00059: Event Response and Reporting [59]	

[5] This document is identified in the governance in BP-PROG-08.01-R008 [25], but is in 'reserve' status.

Level 1	Level 2	Level 3	Level 4
	BP-PROG-09.02: Stakeholder Interaction [60]	BP-PROC-00402: Duty Media Officer [61]	
	BP-PROG-12.01: Conduct of Plant Operations [62]	DIV-OPB-00001: Shift Station Complement – Bruce B [63]	TQD-00005: Emergency Response Organization Training and Qualification Description [64]
	BP-PROG-08.02: Nuclear Security [65]		

Changes to Emergency Planning/Preparedness Related to the Fukushima Response

Follow-up by Bruce Power to the Nuclear Industry's lessons learned (including the CNSC's Action Items) to the Fukushima-Daiichi severe accidents initiated from the combined magnitude 9.0 and subsequent Tsunami that struck Japan on March 11, 2011 has resulted in significant improvement to Bruce Power's emergency preparedness capability. These improvements, some detailed in Section 5.1, are summarized as follows:

a) Physical changes to the plant to enhance accident management such as water addition tie-in points to heat transport and moderator, enhanced shield tank pressure relief, third Emergency Power Generator (EPG),

b) Emergency mitigating equipment to provide additional cooling water and power supplies,

c) Improved severe accident modeling capability,

d) Improved assessments and assurance of instrumentation and equipment survivability and plant habitability following severe accidents,

e) Improvements to severe accident management procedure to enhance response to severe accidents, including multi-unit and Irradiated Fuel Bay (IFB) events,

f) Improvements in communications capability both within the site and with outside agencies,

g) The addition of an off-site Emergency Management Centre and the use an Incident Management System approach to emergency response,

As stated in Section 5.1, collectively these improvements are considered a strength for the emergency preparedness component of emergency planning.

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.

In the review of this Safety Factor, a clause-by-clause assessment of CNSC REGDOC-2.10.1 [23] and CNSC REGDOC-2.3.2 [27] is to be performed per the Bruce B PSR Basis Document [5]. However, both these REGDOCs are now a condition of the LCH [2], requiring transition plans to be submitted to the CNSC and full compliance by September 30, 2015 and December 31, 2018, respectively. Given that these documents are now part of the licensing basis, non-compliances to be addressed by transition plans would not normally be identified as gaps. Nonetheless, to maintain continuity with the ISR for Bruce A [17], such non-compliances are identified as gaps in this Safety Factor review. It should be noted that whether there is a need to address such gaps in the GAR or IIP will be left to those processes.

5.1. Overall Review of Emergency Planning

This review task requires an overall review be performed to check that emergency planning at the plant continues to be satisfactory and to check that emergency plans are maintained in accordance with current safety analyses, accident mitigation studies and good practices.

Bruce Power's Nuclear Emergency Response Plan, BP-PLAN-00001 [24] is referenced in the LCH [2] and is subject to document version control such that changes to Bruce Power's Nuclear Emergency Response Plan require notification to the Commission, or a person authorized by the Commission, prior to implementation.

Bruce Power's Nuclear Emergency Response Plan [24], and supporting station and generic documents listed in Appendices B and C of the Nuclear Emergency Plan, include:

a) On-going review of corporate risks (conducted a minimum of every five years) to determine planning requirements;

b) A planning basis that, in addition to DBAs, takes into account requirements to support a sustained response to a Beyond Design Basis multi-unit event resulting in an extended loss of off-site power for up to 72 hours without assistance;

c) The designation of persons for directing on-site activities and for ensuring liaison with off-site organizations;

d) The conditions under which an emergency shall be declared, a list of job titles and/or functions of persons empowered to declare it, and a description of suitable means for alerting response personnel and public authorities;

e) The arrangements for initial and subsequent assessment of the radiological conditions on and off the site;

f) Provisions for minimizing the exposure of persons to ionizing radiation and for ensuring medical treatment of casualties;

g) Assessment of the state of the installation and the actions to be taken on the site to limit the extent of radioactive release;

h) The chain of command and communication, including a description of related facilities and procedures;

i) An inventory of the emergency equipment to be kept in readiness at specified locations;

j) The actions to be taken by persons and organizations involved in the implementation of the plan; and

k) Provisions for declaring the termination of an emergency.

The overall review of emergency planning performed as part of this Safety Factor (review task 1) includes:

a) Reviews against modern codes and standards - A clause-by-clause review with the requirements and guidance in CNSC REGDOC-2.10.1 [23] and CNSC REGDOC-2.3.2 [27] documented in Appendix B, and a high level review against CSA N1600 [37] and IAEA GSR Part 7 [40] documented in Appendix A;

b) Review of Implementation - reviews of audits, reviews, evaluations, self-assessments and performance indicators documented in Section 7; and

c) Review of changes made as a result of current safety analyses, accident mitigation studies and good practices.

The assessment of Bruce Power's program for emergency planning against the codes and standards includes consideration of not only whether there is direct or indirect compliance against a clause, but also whether any non-compliance represents an acceptable deviation with the clause. Details of the assessments are provided in Table B1, Table B2 and Table A1 and Table A2, and the gaps are summarized as follows:

CNSC REGDOC-2.10.1 [23]:

- Severe Accident Management Guidance (SAMG) implementation that will input to the planning basis to cater to a wider range of multi-unit severe accidents is in progress (clause 2.1),
- Upgrade to the Emergency Response Plan (ERP) code to allow multi-unit dose projection modeling capability remains in progress,
- Security arrangements to prevent nuisance factors from interfering with emergency response are not addressed in the Bruce Power Nuclear Emergency Response Plan (BPNERP) (clause 2.2.6),
- While the basic structure for recovery plans is in place, it is considered that intent of REGDOC-2.10.1 with respect to recovery from a nuclear emergency is not fully met (clause 2.2.8).

CNSC REGDOC-2.3.2 [27]:

No gaps were identified for this updated standard, which is substantially the same as the version referenced in the LCH.

CSA N1600 [37]:

- There are a number of detailed additional requirements in CSA N1600 that would need to be addressed for the full implementation of the current version of the standard. The more significant of these include: an evaluation of losing critical functions which might impact the ability to respond and recover from an emergency (clause 4.2.3); processes for deviating from emergency response plans or recovery plans (clauses 4.5.2, 4.5.12, 5.4); and detailed requirements for nuclear emergency recovery plans (clause 4.6.1).

IAEA GSR Part 7 [40]:

- Clause 5.49 requires that arrangements be made to ensure that emergency response staff are fit for the intended duty. These arrangements shall include health surveillance for emergency workers for the purpose of assessing their initial fitness and continuing fitness for their intended duties. It should be noted that Draft REGDOC-2.2.4, Human Performance Management - Fitness for Duty, was issued by the CNSC in November 2015 [67].
- Clause 5.52 requires that arrangements are in place for the protection of emergency workers and helpers that include:
    - Medical examination, longer term medical actions and psychological counselling, as appropriate.
- Clause 5.53 requires that all practicable means are used to minimize exposures of emergency workers and helpers in an emergency in the response to a nuclear or radiological emergency (and to optimize their protection. It is not clear how this is demonstrated.
- Clause 5.57 requires that emergency workers incur doses in excess of 20 mSv voluntarily, clearly and comprehensively informed in advance of risks as well as available protective measures, trained to the extent possible in the actions they might be required to take, and if not designated in advance, shall not be the first emergency workers chosen for taking actions that could exceed the dose limits. These detailed criteria are currently not reflected in the Emergency Preparedness program and supporting documentation.
- Clause 5.60 requires qualified medical advice to be obtained before any further occupational exposure occurs if an emergency worker has received an effective dose exceeding 200 mSv, or at the request of the emergency worker.
- Clause 6.11 requires that for multi-unit facilities, an appropriate number of suitably qualified personnel shall be available to manage an emergency response at all facilities if each of the facilities is under emergency conditions simultaneously.

Assessed against the codes and standards of Appendix A and Appendix B, Bruce Power's overall program for emergency planning continues to be satisfactory.

With respect to implementation, while the most recent audit [68] points to some deficiencies and discrepancies between the overall plan and the implementing documents, these are not

considered significant to invalidate the conclusion that emergency planning implementation also continues to be satisfactory overall. These findings include:

- There are non-adherences to some Nuclear Emergency Response procedures and forms in the areas of public information, performance measurement, staff selection, facility equipment maintenance, record retention and information management.
- Some Nuclear Emergency Response Plan documents have errors, inconsistencies, and omissions.
- Training for Emergency Plan personnel assigned to the Emergency Management Centre (EMC) does not adhere to the requirements of BP-PROG-02.02-R012, “Worker Learning and Qualification” for Systematic Approach to Training (SAT).
- Agreements with some external agencies have not been maintained.

(Note that as of the writing of this report, the last two findings have been addressed.)

The finding on staff selection from the most recent audit [68] is similar to the findings of lack of Bruce Emergency Services Team (BEST) qualification from the self-assessment on out of station ERO complement, SA-TRGD-2011-09 [69] (See Section 7.1, and SF13-1 in Table 8).

CNSC Type II Inspections of the Fall 2013 emergency exercise [70] also identified various issues for Bruce Power follow-up relating to the validation process for Emergency Mitigating Equipment (EME) guidance, and execution of key operator actions during emergency exercises (See Section 7.3, and SF13-1 in Table 8).

Also, as indicated in the Bruce Power transition plan for full compliance with REGDOC-2.10.1 [71], there is a need to complete the On-Site/Off-Site Emergency Response Communications Project to ensure that two independent means of communication are available to all emergency centres (see SF13-1 in Table 8).

On-going reviews of changes to emergency planning, including Fukushima Action Item follow-up studies [72][73][66], Huron Challenge Series follow-up [74], and review of the licensing basis for minimum shift complement [75], have resulted in a number of changes to emergency planning and supporting processes, including:

- Implementation of an “Incident Management System” organization structure to emergency response, including role re-alignment;
- A new EMC including the installation of a back-up power supply to ensure the EMC is capable of providing continuous AC power to critical building loads and equipment for at least 72 hours after a Beyond Design Basis Accident;
- Communications upgrades both at the new EMC and the Central Maintenance and Laundry Facility (CMLF);
- Confirmation that the minimum shift complement is adequate for the emergency plan’s planning basis;
- Confirmation that an all-hazards approach is adequate to respond to a sustained loss of off-site power multi-unit event beyond design basis accident;

- Implementation of EME and EMEGs and updates to SAMG to reflect new insights and incorporate multi-unit events, including Irradiated Fuel Bay events;
- Re-evaluation of external events using modern methods;
- Instrumentation and equipment survivability studies;
- Control room and plant habitability studies;
- Multi-unit severe accident modeling capability;
- Installation of Passive Autocatalytic Recombiners (PARs), enhanced shield tank overpressure protection, and engineered safety features to provide water make-up capability;
- Installation of off-site real time radiation monitoring instrumentation;
- Development of emergency response simulation software to enhance training for greater understanding and situation awareness of event response.

Overall, it is assessed that emergency planning for Bruce B continues to be satisfactory. In particular, emergency preparedness is identified as a strength.

5.2. Consideration of Significant Changes at Site

For this review task, it will be verified if the operating organization has given adequate consideration to significant changes at the site of the nuclear power plant and in its use, organizational changes at the plant, changes in the maintenance and storage of emergency equipment and developments around the site that could influence emergency planning.

There have been no significant changes at the site such that consideration was required for changes to the emergency planning. However, the planning basis and the implementing procedures for the nuclear emergency plan are reviewed as a result of on-going review of corporate risks and as driven by other processes (e.g., Operating Experience (OPEX), Auditing requirements, Exercises and Drills, CNSC Fukushima Action Items, business needs etc.).

It is concluded that adequate consideration has been given regarding impact of changes on emergency planning. No changes at site have driven consideration of changes to emergency planning. Bruce Power meets the requirements of this review task.

5.3. Additional Evaluations and Examinations

5.3.1. Adequacy of On-Site Equipment and Facilities for Emergencies

The emergency response plan maintenance requirements are defined in Section 4.1.3 of the Bruce Power Nuclear Emergency Response Plan [24]. These include a variety of review and assessment mechanisms as further defined by implementing procedures, including maintenance and testing of equipment and facilities [76], drills and exercise [48], administrative requirements management, and program assessment [47] (which includes quality assurance

assessments, self-assessments, and independent assessments). These processes, in conjunction with other reviews described in Section 5.2, provide regular reviews of the adequacy of and need for changes to on-site equipment and facilities. For example, Fukushima Action Item completion activities have resulted in emergency mitigating equipment being implemented in response to potential multi-unit station loss of power events and site boundary real time radiation detection instrumentation.

While adequate processes exist to ensure the adequacy of equipment and facilities for emergencies, the latest audit, AU-2014-00005 [68] Adverse Finding No. 1 points to procedural non-adherences that result in a number of equipment deficiencies (e.g., lack of a brochure on what to do in the event of an emergency, emergency area assembly area cabinet equipment missing, defective or expired, out of date or uncontrolled documents at emergency plan facilities). Nonetheless, the audit concluded that facilities and equipment are being maintained on a routine basis.

As detailed in section 7.2.2.2, the 2015 Operational Safety Review Team (OSART) review [77] identified a number of issues related to the adequacy of on-site equipment and facilities for emergencies, specifically:

- confirming worker safety should parts of the plant become uninhabitable flowing a four unit severe accident
- the number of electronic personal dosimeters dedicated to emergency response personnel,
- potential delays in obtaining personal protective equipment from stores if access is impeded,
- lack of severe accident dispersion calculations; and potential errors from the use of manual accounting method for centre of site staff during emergencies or site evacuation.

These have been captured as gaps (SF13-3 in Table 8).

Overall, however, it is concluded there is adequate on-site equipment and facilities for emergencies.

5.3.2. Adequacy of On-Site Technical and Operational Support Centres

The on-site technical and operations support centres, i.e., the Main Control room, and the Emergency Operations Centre, are equipped with the necessary communications and other equipment as described in Section 4.1.2.2 of the Bruce Power Nuclear Emergency Response Plan [24]. The emergency response plan maintenance requirements are defined in Section 4.1.3 of the Bruce Power Nuclear Emergency Response Plan [24]. These include a variety of review and assessment mechanisms as further defined by implementing procedures, including maintenance and testing of equipment and facilities [76] which include the Emergency Operations Centre (EOC), drills and exercise [48], administrative requirements management, and program assessment [47] (which includes quality assurance assessments, self-assessments, and independent assessments). These provide assurance of the process for

ensuring the adequacy of these on-site centres. As indicated in Section 5.3.1, facilities and equipment are being maintained on a routine basis [68].

Note that Bruce Power has recently consolidated the Site Management Centre and the Corporate Emergency Support Centre into an Emergency Management Centre located at the Bruce Power Visitor's Centre in order to improve arrangements, including supporting a new Incident Management System, and making ensuing changes to the emergency plan and procedures [74]. Procedures have been issued to cover the EMC positions, and drills have been performed to test the capabilities of EMC equipment and staff. However, the OSART review [77] (see section 7.2.2.2) identified that radiation protection for EMC staff may not be sufficient. There is lack of a filtered ventilation system, and although the EMC can be relocated, this may delay the emergency response. This is identified as a gap (SF13-3 in Table 8).

Thus it is concluded that the on-site technical and operational support centre are adequate.

5.3.3. Efficiency of Communications in the Event of an Emergency

As described in Section 4.1.2.2 of the Bruce Power Nuclear Emergency Response Plan [24], multiple means of communications are available to the emergency response organization responders in responding to an emergency within the site:

- Station Private Branch Exchange (PBX) is the primary telephone system. Bruce A and Bruce B have a back-up PBX or sufficient external trunk lines are provided in the main emergency response facilities to provide adequate back-up communications capability.
- Cellular phones are available and Satellite phones installed at each Unit 0 Main Control Room are used as back-up in the event of a phone outage. Fax machines equipped with station PBX and trunk lines are available.
- Both Bruce A and Bruce B have an emergency radio communications system with three dedicated frequencies. On-site and off-site field teams are equipped with portable radios. Base radio stations are available at a number of on-site locations such as the Main Control Room (MCR) and the Emergency Operations Centre (EOC). Off-site field team vehicles are equipped with mobile radio systems and back-up portables.
- A small fleet of deployable radio repeaters is also available for emergency deployment to augment degraded or overwhelmed radio channels outside the stations.

As a result of Fukushima Action Item completion [66], communications upgrades have been completed, including a radio communications infrastructure and satellite phone capability both at the new EMC and the CMLF. Further enhancements included the installation of a VSAT (Very Small Aperture Terminal) system at the EMC to provide multiple backup phone hubs and internet connectivity. These upgrades address connectivity issues between the EMC and station EOC as well as external agencies.

On-site staff are marshalled by the station emergency tone, and various communications technologies and fan-out notifications for ERO augmentation and off-site emergency notifications (Section 4.2.2.5 of BP-PLAN-00001 [24]). Table 2 of the Bruce Power Nuclear Emergency Response Plan [24] provides the communication interfaces for the ERO. The

Emergency Management Centre provides the ongoing operation interface with external agencies and authorities (e.g., the Provincial Emergency Operations Centre (PEOC) and the CNSC's Headquarters Emergency Operations Centre (HQEOC)).

On-going emergency drills and exercises test the efficiency and effectiveness of communication links.

Audit results from AU-2014-0005 [68] identify the need for improvements in the effectiveness of public information in the event of an emergency. However, these are not identified as gaps for the purpose of this assessment. However, the OSART review [77] (see Section 7.2.2.2) identified that procedural guidance for shift managers to prioritize emergency classification could potentially lead to a delay in classifying an emergency and off-site notification. In addition the OSART review [77] (see section 7.2.2.2) identified that there is lack of specific public address system announcements for multi-unit severe accidents. These are identified as gaps (SF13-3 in Table 8).

Thus, it is concluded that that the review task of efficiency in communications in the event of an emergency is adequate.

5.3.4. Content and Effectiveness of Emergency Training and Exercises

Emergency Response Organization Training and Qualification Description, TQD-00005 [64], establishes the requirements for the training and qualification of individuals assigned to specific emergency response positions, as defined in BP-PLAN-00001 [24], following a systematic approach to training methodology. Emergency Preparedness Drill and Exercises, B-PROC-00010 [48], provides a comprehensive list of drill and exercise objectives and provides for a schedule for conducting drills and exercises such that all of the objectives are tested within a set period of time. The schedule is reviewed at least quarterly. The CNSC is included on the distribution list.

The Bruce Power programs in this area provide the basis for ensuring this review task is met. However, a CNSC Action Notice from a Type II inspection performed during the fall 2013 exercise [78] indicated required improvements in ensuring key operator actions are identified and executed during emergency exercises. Following improvements communicated by Bruce power, the CNSC Action Notice was closed [79].

5.3.5. Arrangements for Regular Review and Updating of Emergency Plans and Procedures

The emergency response plan maintenance requirements are defined in Section 4.1.3 of the Bruce Power Nuclear Emergency Response Plan [24]. These include a variety of review and assessment mechanisms as further defined by implementing procedures, including drills and exercises [48], administrative requirements management, and program assessment [47] (which includes quality assurance assessments, self-assessments, and independent assessments). These processes, in conjunction with planning basis review processes, OPEX, and external jurisdiction reviews described in Section 5.1 provide regular reviews of the adequacy and need

for updating of emergency plans and procedures. Also, per BP-PROC-00166 [80], all controlled documents are flagged for periodic reviews through Action Requests.

As noted in the review of CSA N1600 [37] documented in Appendix A.1, there are a number of detailed additional requirements in CSA N1600 that would need to be addressed for the implementation of the current version of the standard. In addition there are increased expectations in IAEA GSR Part 7 [40] that would need to be addressed. These have been captured as gaps (SF13-2 in Table 8).

As detailed in Section 7.2.2.2, the OSART review [77] identified a lack of severe accident dispersion calculations; and potential errors from the use of manual accounting method for centre of site staff during emergencies or site evacuation (SF13-3 in Table 8).

Thus, it is concluded that while the Bruce Power program and procedures meet the requirements of this review task, although there is a gap in implementation.

5.3.6. Changes in Maintenance and Storage of Emergency Equipment

The only significant change in maintenance and storage of emergency equipment since the 2008 Bruce 3 and 4 ISR [12] relates to the use of portable emergency diesel generators that is provided by Emergency and Protective Services (EPS) for energizing Unit 0 Qualified Power Supply Loads in the event of loss of Class IV and Class III power [81]. The emergency diesel generators are stored outside the protected area in a heated location and are under the ownership of the EPS organization. Standard Operating Guidelines have been created to provide direction on how to clear a designated path, and retrieve and set up the equipment. However, this did not require a change to the Nuclear Emergency Response Plan [24].

5.3.7. Effects of any Recent Residential and Industrial Developments Around the Site

There has been no recent significant residential and industrial development around the site.

6. Interfaces with Other Safety Factors

There is some degree of interrelationship among most of the 15 Safety Factors that comprise the Bruce B PSR. 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 5.8, addresses design provisions to facilitate accident management.
- “Safety Factor 5: Deterministic Safety Analysis” in Section 5.7, addresses the review of the existing Deterministic Safety Analysis for design basis accidents and beyond design basis accidents used in support of the emergency procedures and technical basis for Severe Accident Management Guidance.

- "Safety Factor 9: External OPEX and R&D" in Section 5.3.3.1, exemplifies the ongoing review of the scope of Bruce Power's accident management approach and provisions in light of external OPEX.
- "Safety Factor 10: Organization and Administration" in Section 5.4.5, addresses effectiveness of the station condition record (SCR) process in resolving adverse conditions.

For the purposes of this assessment, the following scopes have been assumed for Safety Factors 13, 14 and 15:

- "Safety Factor 13 (this report): Emergency Planning" has been interpreted to include the preparations made for the protection of people and the environment from the adverse effects of exposure to ionizing radiation during abnormal operations;
- "Safety Factor 14: Radiological Impact on the Environment" has been interpreted to include the protection of people and the environment outside the Protected Area of the station from the adverse effects of exposure to ionizing radiation during normal operations which includes anticipated operational occurrences; and
- "Safety Factor 15: Radiation Protection" has been interpreted to include the protection of people inside the Protected Area of the station from the adverse effects of exposure to ionizing radiation during normal operations which includes anticipated operational occurrences (there are no natural areas of any significance inside the Protected Area of the station).

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 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 each assessment are compared with business needs, the Bruce Power management system, industry standards of excellence and regulatory/statutory or other legal requirements. Where gaps are identified, corrective actions are identified and implemented.

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.

Between 2011 and 2015, three self-assessments relevant to emergency planning were performed, in addition to drills and exercises.

1) SA-TRDG-2012-06 ERO Training Program [82]

   In response to Action Notice #1 of TPED-BNGSAB-2009-T16678-T1, the training for six Emergency Response Organization "preparedness" groups (Duty Areas), consisting of 35 qualifications in total, was investigated:

   - Emergency Response Organization - Corporate Emergency Support Centre (CESC – 5 Qualifications)
   - Emergency Response Organization - Site Management Centre (SMC – 9 Qualifications)
   - Emergency Response Organization - Emergency Operations Centre (EOC – 7 Qualifications)

- Emergency Response Organization - TEAM (8 Qualifications)
- Emergency Response Organization - OTHER (5 Qualifications)
- Emergency Response Organization - Transportation Emergency Response Plan (1 Qualification)

Strengths were identified in that this training program has been analyzed, designed, developed and implemented to comply with the Bruce Power training standards and the requirements of the Systematic Approach to Training (SAT). Review of current supporting documentation indicates that the training program has a sound reference base and that training support materials have been recorded properly. No adverse conditions were identified.

No gaps are identified from this self-assessment.

2) SA-TRGD-2011-09 Out of Station ERO Complement Quals [69]

The objective of this self-assessment was to review the process to maintain minimum complement qualifications for the Bruce Emergency Services Team (BEST[6]) organization per DIV-OPA-00001 and DIV-OPB-00001. Results indicated that minimum qualification requirements are not understood, and therefore not checked to ensure BEST assigned minimum complement positions are fully qualified. Without this information, BEST members are being placed into minimum complement positions for which they are not fully qualified. The following issues were identified:

- People are being assigned minimum complement positions for which they are not fully qualified.
- BEST are calling BEST members to work overtime to replace someone who has been assigned a specific ERO minimum complement position without checking to see if the person they are calling actually has the qualification needed.
- BEST are hiring (nuclear emergency response plan) Appendix A employees and assigned to minimum complement before they are qualified ESM1's (Emergency Services Maintainer 1).

This self-assessment was performed in 2011 on an organizational structure that is no longer in place. While the findings may not be directly relevant, when combined with audit findings from AU-2014-00005 (See Section 7.2) and issues identified in self-assessment SA-TRGD-2014-06 [35], represent a recurring problem with staff selection for the ERO organization (See Section 5.1 and SF13-1 in Table 8).

3) SA-TRGD-2014-06, Complement Qualifications (TQD-00088) [83]

This self-assessment identifies that the qualification pre-requisites for several complement qualifications and identifies Qualification 10652 ERO – Shift Resource Coordinator not being

[6] "BEST" terminology is no longer used. Current reference in documentation is now either to Emergency and Protective Services (EPS) or to the Emergency Response Team (ERT), as appropriate.

listed as a pre-requisite for the Bruce B Fuel Handling Control Room Operator, even though the latter are expected to fill the role of the Shift Resource Coordinator. As noted above, this represents a recurring problem with staff selection for the ERO organization (see Section 5.1 and SF13-1 in Table 8).

4) Drills and Exercises

Note that the Bruce Power Nuclear Emergency Plan also considers the Drill and Exercise program a form of self-assessment, as the drill and exercise program will provide a list of findings for which the Emergency Management Department may initiate a causal factor evaluation as appropriate and initiate corrective actions.

Table 6 and Table 7 provide a summary of drills and exercises performed during the period 2010 to end of 2015 as well as any findings, as summarized from the various accompanying reports [84]. As the emergency management program is largely similar between Bruce A and Bruce B, Bruce A experience is considered relevant and hence considered in the review of this Safety Factor.

Table 6: Summary of Emergency Drills

Date	Location of Drill	Findings
14Jan2010	Bruce B	• Fax number for London OPP incorrect in BP-ERP-00002
28Jan2010	Bruce B	None
11Feb2010	Bruce A Simulator	None
17Feb2010	Bruce A	None
25Feb2010	Bruce A Simulator	None
14Jul2010	Bruce (Off-Site Warning Siren Full Volume Test)	None
29Sep2010	Kincardine (Off Site Centres)	None
18Oct2010	Bruce B	None

Date	Location of Drill	Findings
10Nov2010	Bruce A	• ERO drill not suspended / terminated for medical emergency • Mutual Assist Response Team (MART) staffing and response problems • Unavailability of the required number of Assembly Area drill evaluators
17Feb2011	Bruce A Simulator	• In Plant Coordinator position not filled for drill • Emergency Shift Assistant (ESA) put in wrong ERO pager code
14Apr2011	Bruce A Simulator	None
29Jun2011	Bruce A	• Lack of Assembly Area Supervisor • Lack of the required Assembly area Drill Evaluators
14Sep2011	Bruce A	• Lack of the required Assembly Area Drill Evaluators
04Jan2012	Bruce A Simulator	None
11Jan2012	Bruce A Simulator	None
25Jan2012	Bruce A Simulator	None
14Nov2012	Bruce A	None
28Nov2012	Bruce A	• Lack of Radiation Instruments in Fuel Handling Maintenance Office Assembly Area
17Jun2013	Bruce B	None
18Sep2013	Bruce A Simulator	None
23Sep2013	Bruce B	None
25Sep2013	Bruce B	None
08Oct2013	Bruce A Simulator	None
23Oct2013	Bruce A	None
06Nov2013	Bruce A	There were differences on MART staffing between DIV-OPB-00001 and FORM-11732 (MART Accounting) which caused confusion at Bruce B when dispatch MART to Bruce A
15Apr2014	Bruce B	None
03Sep2014	Bruce B	Minor • The Emergency Shift Assistant (ESA) was unable to send out an emergency notification

Date	Location of Drill	Findings
		(via the MIR3 notification system) to alert the Emergency Management Centre (EMC) personnel for the drill by Internet. As a result, the ESA followed his procedure (BP-ERP-00002) and went to the backup option which was sending MIR3 modification by phone, which was successful. • Include FORM-12013 Radiological Form in the Offsite Survey team (trucks) vehicles as part of inventory list.
03Sep2014	Bruce B	Minor • The MART from Bruce A did not respond in the required timeframe set in BP-PROC-00010: Exercises and Drills (SCR #28469166) • Potential for future minimum complement violation (SCR#28469166). Minimum Complement staff are allowed outside the security fence (e.g., for tests) if they can return within 10 min. On this particular drill, operators were told by security it could take 1 hr. Shift manager intervention as required to immediately open the access gate.
09Sep2014	Bruce A	None
30Sep2014	Bruce A	None
11Feb2015	Bruce Site (EMC)	None
06-07May2015	Bruce Site (EMC)	• There was no written procedure for the transition from a Design Based Accident to a Beyond Design Base Accident [SCR #28503665] • The EME deployment process and associated tasks for EPS Fire, Bruce Alternate Steam Supply and the Site Ops Chief were not well understood by all work groups [SCR # 28502827] • Many drill players were not referring to or using their position Emergency Response Procedures (EAP5) and the Bruce Power Nuclear Emergency Response Plan, BP-PLAN-00001 as required (SCR # 285028281)

Date	Location of Drill	Findings
19Feb2015	Bruce B	None
15Jul2015	Bruce Site (EMC)	• provincial authority with respect to evacuation in Primary Zone, as specified in Provincial Nuclear Emergency Plan, not well understood by crew • A formalized process for the EMC, once operational, to assume command and control of all centre-of-site activities is required
14Oct2015	Bruce B	Minor • Relocation of Assembly Area resulted in four individuals showing up to account with no one present in the accounting area • Civil maintenance Shop Assembly area phone not working
03Dec2015	Bruce Site (EMC)	None

Table 7: Summary of Emergency Exercises

Date	Location of Exercise	Findings
16Nov2010	Bruce A	• Station Emergency Response delayed by Radiation Emergency Plan selection
28Sep2011	Bruce A	• Lack of the required Assembly Area Drill Evaluators.
15-19Oct2012	Bruce Site	Major • None Minor • EQ Steam Door left open (SCR 28323730) • U7 678' ST2 Steam Barrier Door found propped open (SCR 28323731) • Damage done to 100kw Generator (SCR 28323732)
16-17Oct2013	Bruce Site	None
16-Sep2014	Bruce Site	None
30Sep2014	Bruce A	None

Date	Location of Exercise	Findings
01-03Oct2014	Bruce Site	Major • None Minor • Delay in MART arrival to Bruce B (SCR 28464325) • Radio communications issues (portable radios not functioning well) in the Bruce A EOC (SCR 28459865) • NK29-EME-03504.1 handout 1.4.2 procedural error (instrument air hose could not reach the connection points specified in the procedure (DCR 28459830) • BSRV (Boiler Safety Relief Valve) locking mechanism was blocked by scaffolding preventing manual blocking open of BSRV (SCR 28459830)
07-09Oct2015	Bruce Site	Major • Assembly and Accounting time requirements not met for drill (SCR 28525089) Minor • MART response delayed (SCR 28524997) • Emergency Entry Response Team member had a beard when reporting to the EOC (SCR 28525107) • Delay in setting up contamination control (SCR 28525117) • Some individuals did not account prior to the station emergency tone being actuated (SCR 28521086 & 28521118) • Equipment and location issues within the Construction Retube Building Assembly area (SCR 28521053) • Bruce Emergency Response Projection Code (SCR 28525396) • Lack of awareness of Potassium Iodide tablets inventory and location as part of the on-site distribution plan (SCR 28525387)

Date	Location of Exercise	Findings
		• (SAMG response) Transfer ERO Handwritten Forms into electronic forms (SCR 28524982) • (SAMG response) Unverified strategy decision making by MCR without endorsement of Technical Support Group (TSG) (SCR 28525349)

A MART response issue is evident from the drill and exercise results, which has been identified as gap SF13-1 in Table 8. No other significant issues or trends are evident from the drill and exercise results.

7.2. Internal and External Audits and Reviews

The objective of the audit process as stated in BP-PROG-15.01 [85] 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 [29]).

7.2.1. Internal Audits

This section contains information arising from audits related to this Safety Factor. Internal audits are conducted by the Bruce Power Corporate Oversight and Audit Department. External audits are conducted as deemed appropriate by management by independent organizations (excluding regulators) from outside of Bruce Power.

The Bruce Power Nuclear Emergency Response Plan [24] Section 4.1.3.6 has the following requirement:

> "Bruce Power's NERP is audited by Bruce Power's internal audit organization over a period of three (3) years. The audit program will address the plan, preparedness, and response implementing procedures, equipment, facilities, training, personnel selection, and qualification. Reports of the ongoing audit program and special audits are directed to the

owners of the Policy and Program responsible for the implementation of the NERP. Audit findings will be subject to root cause evaluations as appropriate, corrective actions will be identified, and, a schedule for corrective action will be developed. Important corrective actions will be tracked in the Corrective Action system."

During the period of 2009-2015, the following audits relating to emergency planning were performed:

7.2.1.1. AU-2014-00005, Nuclear Emergency Response Plan [68]

The audit reviewed activities prescribed by BP-PLAN-00001 for the period from June 2011 to May 2014. A sample of the Plan's implementing procedures, drill reports, records, and training documentation were reviewed. Field observations of assembly areas, various emergency facilities on-site and in the local region, and one drill were performed.

The overall conclusion of the audit was that the Bruce Power Nuclear Emergency Response Plan (NERP) was complete; however it has not been fully implemented and it is not being fully complied with. The requirements of CNSC Regulatory Guide G-225 – Emergency Planning at Class 1 Nuclear Facilities and Uranium Mines and Mills [49] were met by performing the activities associated with BP-PLAN-00001-R004 and its implementing documents. There were four Adverse Conditions and one Opportunity for Improvement (OFI) as listed below (see Section 5.1 and SF13-1 in Table 8), each of which had a separate action request (AR) raised (from Executive Summary):

- There are non-adherences to some Nuclear Emergency Response procedures and forms in the areas of public information (no measurement of effectiveness, lack of a brochure in what to do in the event of an emergency, including evacuation routes), ad-hoc method for staff selection, facility and equipment maintenance, record retention and information management.
- Some Nuclear Emergency Response Plan documents have errors, inconsistencies, and omissions.
- Training for Emergency Plan personnel assigned to the Emergency Management Centre (EMC) does not adhere to the requirements of BP-PROG-02.02 R012, "Worker Learning and Qualification" for Systematic Approach to Training (SAT).
- Agreements with some external agencies have not been maintained.
- OFI - Some information on the Bruce Power intranet for the Emergency Response Organization is not being maintained or is inaccurate.

The audit also performed a performance improvement review, and noted the following:

OPEX

There is evidence that Bruce Power is seeking and sharing OPEX through the Fukushima Forums that were held in November 2011, October 2012 and September 2013. Bruce Power sent representatives to all 3 of these forums to participate.

SCRs from Previous Audits

There were six SCRs from surveillance AU-2011-00006, Nuclear Emergency Plan [86] that were reviewed for completion during audit AU-2013-00004, Emergency Measures Program [87]. This review determined that five of six SCRs were not effective at resolving the adverse conditions identified in the surveillance report. As a result SCR 28395294 Corrective Action Process not Always Effectively Used was initiated. The latest audit [68] also found that 5 of the 6 SCRs raised in the 2011 surveillance [86] were not effective in resolving the adverse conditions identified therein. Since SCR effectiveness is not addressed until the next audit cycle, 3 years later and repeat findings exist, and Focus Area Self-Assessment (FASAs) have not recently been performed in this area, this issue is assessed as a gap (SF13-1).

Two other SCRs were initiated following AU-2013-00004. Previously those SCRs would receive a completion assurance review as scheduled by the corrective action process. The audit process has changed such that SCRs will only receive a completion assurance review during the next audit. Therefore the SCRs from this audit and AU-2013-00004 will be reviewed during the next Nuclear Emergency Response Plan audit in 2017.

Focus Area Self Assessments (FASAs)

The audit noted that no FASAs have been completed since AU-2013-00004.

7.2.1.2. AU-2013-00004, Emergency Measures [87]

The objective of this audit was to evaluate the completeness and implementation of BP-PROG-08.01 Emergency Measures Program [88], the (then) parent program for the Bruce Power Nuclear Emergency Response Plan [24], and to evaluate the completeness of the Incident Management System and Emergency Management Centre Implementation Plan. The evaluation included the program document, all program implementing procedures and a sampling of lower tier procedures. The scope for the implementation plan review included the MS Project IMS and Emergency Management Centre (EMC) Implementation Plan (dated 17 June 2013).

The audit [87] concluded that BP-PROG-08.01 Emergency Measures Program and its implementing procedures were found not complete and not fully implemented. Specifically, the audit resulted in the following three adverse conditions and three opportunities for improvement, each of which had a separate SCR raised:

- BP-PROG-08.01, Emergency Measures Program [88] was not effectively managed to ensure that the program document is fully compliant with Bruce Power program requirements**.** This may increase the risk of not being able to demonstrate full compliance with the relevant requirements. CSA N286-05, Management System Requirements for Nuclear Power Plants [29] section 5.1 requires that the business is defined, planned and controlled.
- The corrective action process has not always been effectively used by the Emergency Measure Functional Area to analyze and correct identified issues. This has resulted in rework and adverse conditions that are allowed to continue with the increased risk they present. This is a repeat condition.

- The implementing procedures for BP-PROG-08.01 Emergency Measures Program do not always meet prescribed document management requirements. This may increase the likelihood of human error and inconsistent results.
- OFI - Align Emergency Measure Processes with BP-PROC-00166-R023 [80].
- OFI - External Auditor Recommendations for IMS/EMC.
- OFI - Conduct a Focused Area Self-Assessment on Severe Accident Guidelines.

7.2.1.3. AU-2011-00006, Nuclear Emergency Plan [86]

This audit is considered superseded by the more recently performed AU-2014-00005 [68]. An audit of the Nuclear Emergency Response Plan is required to be conducted every 3 years, and the scope of the audit is the same, such that any significant repeat findings will have been captured in the later audit. In addition, this audit reflects an outdated emergency response organization.

7.2.1.4. AU-2010-00029 Reporting of S-99 Emergency and Fire Events [89]

This audit was performed to address a concern that identification and reporting of declaration of emergency and fires may not be consistent with S-99. From the data reviewed, it was concluded that, reporting of events to the CNSC under S-99 Sections 6.3.1(36), declaration of an emergency, is consistent with the S-99 reporting requirements (Section 2.1, [89]).

7.2.2. External Audits and Reviews

The Bruce Power Nuclear Emergency Response Plan [24] Section 4.1.3.6(3) has the following requirement for independent assessment:

> "Bruce Power management can initiate an external, independent assessment of the Emergency Management Program at any time. Such an assessment will be initiated when performance indicates a need for it. Such action is also warranted if it is determined that it will be a necessary enhancement to the self-assessment process and the audit programs."

7.2.2.1. Review Against CNSC Fukushima Task Force Recommendations

One external audit during the 2011-2015 period was conducted as described in AU-2013-00004 [87] which stated the following (Section 2.2):

> "A review was conducted of the Bruce Power IMS/EMC Plans (printed 12 July 2013) and the Bruce Power response letter NK21-CORR-00531-10560 / NK29-CORR-00531-10963 / NK37- CORR-00531-02077 Bruce Power Progress Report No. 3 on CNSC Action Plan – Fukushima Action Items (17 July 2013) against the INFO-0828 CNSC Fukushima Task Force Recommendations (December 2011) to determine the completeness of the plan. The review was conducted by external subject matter experts (SMEs) from VC Summer Station

(South Carolina) and AECL (Chalk River, Ontario) and concluded that the actions taken and the plans meet the intent of the CNSC task force recommendations. Actions from the Fukushima Action Items (FAI) are continuing to be worked and the deliverables requested by CNSC have been provided."

7.2.2.2. Operational Safety Review Team Assessment

The IAEA coordinates internationally-based teams of experts who conduct reviews of operational safety performance at nuclear power plants. This team is referred to as Operational Safety Review Team (OSART). Rather than examining the plant's physical design, OSART team members are tasked with studying the operation of the plant and the performance of the plant's management and staff. OSART focuses more on the human aspect of a nuclear plant rather than the technology behind its operation.

Bruce B was the subject of an IAEA Operational Safety Review Team (OSART) review from November 30 to December 17, 2015. Bruce Power prepared an extensive Advance Information Package primarily for the Team on the important aspects of the operation of Bruce B [90]. The results of the OSART review were finalized in report prepared by the team [77]. The review areas in Reference [91] that encompass review tasks associated with Safety Factor 13 are:

- Section 9: Emergency Preparedness and Response, which encompasses the capability to take actions (i.e., infrastructure available) and the performance of actions to mitigate the consequences of an emergency, respectively.
- Section 10: Severe Accident Management

Emergency Preparedness and Response

The team found that the overall emergency response arrangements of the plant are robust and the plant is implementing an ongoing improvement program. In particular, the team noted good practices in the following areas:

- Arrangements to ensure the quick and effective availability of iodine prophylaxis in an emergency warranting protective action for the public.
- Off-site (real-time) gamma dose-rate monitors
- Public alerting

The team raised a number of issues (SF13-3):

- The protection of onsite personnel in an emergency situation is not sufficiently robust. Concerns centred around: confirming worker safety should parts of the plant become uninhabitable following a four unit severe accident; the number of electronic personal dosimeters dedicated to emergency response personnel: lack of specific public address system announcements for multi-unit severe accidents; potential delays in obtaining personal protective equipment from stores if access is impeded; lack of severe accident dispersion calculations; and potential errors from the use of manual accounting method for centre of site staff during emergencies or site evacuation.

- Procedural guidance for shift managers to prioritize emergency classification potentially leading to delay in classifying an emergency and off-site notification
- Radiation protection for emergency management centre EMC staff may not be sufficient. There is lack of a filtered ventilation system, and although the EMC can be relocated, this may delay the emergency response.

Accident Management

The team identified as a good practice the strategy for rapid deployment of Emergency Mitigating Equipment.

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 licensees 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.

7.3.1. Annual CNSC Oversight Report

Emergency Management and Fire Protection is one of the elements reviewed by Canadian Nuclear Safety Commission staff during their annual assessment of the safety performance of the Canadian nuclear power industry. The CNSC produces an annual report on the safety performance of Canada's Nuclear Power Plants (NPPs). The report for 2014, Regulatory Oversight Report for Canadian Nuclear Power Plants: 2014, issued in September 2015 [92], summarizes the 2014 ratings for Canada's NPPs in each of the 14 CNSC Safety and Control Areas (SCAs), including emergency management and fire protection, which covers emergency plans and emergency preparedness programs for dealing with radiological, nuclear and conventional emergencies. For 2014, the Bruce B rating for the emergency management and fire protection SCA was "satisfactory". In their 2013 annual review [93], the CNSC provided a rating of "SA", or satisfactory, for Bruce B. In particular, with respect to nuclear emergency preparedness and response, the CNSC report that they "conducted an inspection of the planned

emergency exercise at Bruce A and B in 2013. The inspection team concluded that overall, Bruce Power demonstrated its readiness to respond to a nuclear emergency" (Section 3.1.10, [93]).

7.3.2. CNSC Type II Inspections

7.3.2.1. BRPD-AB-2015-012 - Bruce Power 2015 Corporate Emergency Exercise [94]

As a result of this inspection, the CNSC raised two action notices:

1. In order for Bruce Power to become compliant with BP-ERP-00002, CNSC staff requests that Bruce Power develop a corrective action plan which could include enhanced training to ensure all emergency staff are aware of and understand the duties assigned to their respective roles.
2. In order for Bruce Power to become compliant with BP-PROC-00069, CNSC staff requests that Bruce Power develop a corrective action plan which could include enhanced training to ensure all emergency staff are aware of all the positions within the Emergency Response Organization (ERO) especially those of the Emergency Management Centre (EMC).

As of the time of writing of this report, the Bruce Power response had not yet been provided.

7.3.2.2. BRPD-AB-2015-004 – Fukushima Verifications [95]

The inspection focused on assessing compliance of a sample of engineering design change packages and procedures resulting from FAIs. One Action Notice and 8 Recommendations were raised. The Action Notice relates to revising DPT-PDE-00013 (Human Factors Engineering) to meet the process requirements of BP-PROC-00166 in regards to the procedure verifier being a member of Bruce Power. On the basis of Bruce Power addressing all eight recommendations, and agreement to undertake the necessary corrective actions to address the findings, CNSC closed the associated action item [96].

7.3.2.3. BNPD-AB-2014-018 - ERO Training [97]

As a result of this inspection, the CNSC raises two Action Notices and five Recommendations. Action notices relate to:

1. Action Notices relate to compliance with -PROC-00174, Training - Administer Training Exemption related to training exemption forms, and
2. Compliance with BP-PROG-02.02, Worker Learning and Qualification related to ensuring that the ERO training program is systematically analyzed, designed, developed, implemented and evaluated.

Completion of the Action Notices is documented in [98][91].

7.3.2.4. BRPD-AB-2014-016 – Bruce Power Fall 2014 Emergency Exercise [99]

As a result of this inspection, there were no formal actions placed on Bruce Power (three recommendations were made).

7.3.2.5. BRPD-AB-2014-005 Fukushima Action Item Field Verification [100]

This inspection was conducted by CNSC staff to assess completion of the commitments to the Fukushima Action Items. CNSC staff was satisfied that Bruce Power procured equipment and made modifications consistent with what was communicated in semi-annual progress reports.

7.3.2.6. BRPD-AB-2013-019 – Bruce Power Fall 2013 Emergency Exercise [70]

The CNSC performed a Type II Inspection of the Bruce Power Fall 2013 Emergency Exercise. The inspection verified compliance by Bruce Power with regulatory requirements in the licence and with RD-353 [101][84]. In addition the criteria in BP-PLAN-00001, and related Bruce Power procedures were used. The CNSC noted that the exercise that was held by Bruce Power was challenging in scope and fulfilled the stated objectives that the exercise was to cover, albeit the exercise was cut short and therefore players did not have a chance to complete all the tasks. The exercise also included some new response criteria such as dealing with loss of power and deployment of emergency mitigation equipment. The exercise also tested interfaces with the Emergency Management Centre (EMC) which Bruce Power plans to activate in the near future to replace the Site Management Centre located in B06. The CNSC also noted that the findings were mostly positive, with eight recommendations raised as a result of the exercise. Bruce Power's responses to the recommendations are provided in [102] accepting the recommendations.

7.3.2.7. BRPD-A-2013-010 - Emergency Operating Procedures & Minimum Shift Complement Validation [77]

The CNSC also performed a Type II compliance inspection of Emergency Operating Procedures & Minimum Shift Complement Validation during the same period as the Fall 2013 emergency exercise [70]. The following positive observations were made:

- There is a mechanism in place to ensure that the most recent version of an Abnormal Incidents Manual (AIM) procedure is used.
- Circumstances in which a procedural deviation is permitted are understood by certified staff and the associated station expectations are complied with.
- Certified staff was well trained on the execution of AIMs
- Field handouts were carried out as specified.

- The human performance tools were employed consistently by the field operators.
- Bruce Power used the exercise debriefs to identify procedural flaws, and demonstrated an initiative to incorporate this feedback in future procedure revisions.
- The exercise was as realistic as possible considering it was performed in a fully operational station.
- The controllers/evaluators were qualified.

There were some areas of concern which resulted in two action notices and six recommendations [77].

The Action Notices were (Section 6.0):

1. To ensure compliance with GRP-OPS-00050, CNSC staff requested that Bruce Power review their process for validating EME procedures and initiate corrective actions to ensure the process is documented and the validation is auditable.

2. To comply with BP-PLAN-00001, CNSC staff requested the following:
    - Bruce Power is required to ensure that the key operator actions are performed within the required time during any emergency exercise.
    - Bruce Power is required to review their process for terminating an exercise.
    - Bruce Power is required to perform a more detailed analysis of the key performance objectives to ensure that 1) cooling, and 2) essential monitoring and control was effectively maintained by the timely completion of operator actions during the course of this exercise. Bruce Power should provide all the performance criteria for the key operator actions stated above in the analysis.
    - Bruce Power is requested to confirm whether load shedding was done in Units 1, 2 3, and 4 as well as Unit 0. If these actions were completed, Bruce Power is requested to provide the time at which the task was completed. If this task was not completed in any of the units Bruce Power is requested to provide the reasons why and what would be the consequences. (i.e., would monitoring capabilities exist).
    - Due to early termination, Deaerator makeup to the boilers was not completed. Bruce Power is requested to provide proof that this action would have been able to be completed within the required time.
    - The pumpers were available to provide makeup to the boilers however there were some operator actions still required (i.e., final valve operations). Bruce Power is requested to provide the length of time it would have required to actually provide cooling water to the boilers from the pumpers.

Bruce Power's response accepting the action notices and responding to the Recommendations were provided in Reference [103].

In reply to Bruce Power's request for closure [104] [99], CNSC agreed to close the first Action Notice but requested that Bruce Power re-submit the 2013 Corporate Emergency Exercise Evaluation Report with the addition of actual field action completion times along with a comparison against established acceptance criteria [105]. Bruce Power made a further request to close the Action Item on the basis that the minimum shift complement is predicated on design basis events (which has been demonstrated) and that documentation submitted also provides assurance that the minimum shift complement is capable of responding to a beyond design basis events [106]. At the time of writing of this report, the issue remains open and is identified as a gap (SF13-1 in Table 8).

7.4. Performance Indicators

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

In accordance with CNSC REGDOC-3.1.1 [107], Bruce Power reports on three PIs related to Emergency Preparedness for radiological emergencies (Appendix B: 22, 23, and 24):

1. Radiological Emergencies Performance Index which provides an indication of the percentage of performance opportunities successfully demonstrated during drills, exercises or events during the previous 8 quarters.
2. ERO Drill Participation Index – which provides an indication of the participation rate of key ERO personnel in drills, exercises or events during the previous 8 quarters.
3. Emergency Response Resources Completion Index which provides an indication of the completion percentage of preventative maintenance items, tests and inventory checks scheduled during the quarter.

Detailed definition of these indicators can be found in REGDOC-3.1.1 [107]. These indicators are at the Site level (i.e., both Bruce A and B) and reporting is done quarterly.

For the Radiological Emergencies Performance Index and the ERO Drill Participation Index, Bruce Power has defined "Status Criteria" on whether the indicator results provide an indication of significant strength, satisfactory (performance), improvement needed, or significant weakness.

The quarterly performance indicator reports from 2010Q4 to 2015Q3 [108] were reviewed. Throughout this period, the Radiological Emergencies Performance Index was reported as a significant strength with 100% score for the 8 quarters ending 2015Q3. The Emergency Response Resources Completion Index also showed a 100% completion rate. Except for the last 2 quarters reviewed, the ERO Drill Participation Index fluctuates between "satisfactory" and "improvement needed", largely influenced by the corporate exercise schedule. ERO drill participation rate is thus identified as a gap (SF13-1).

8. Summary and Conclusions

The overall objectives of the Bruce B PSR are to conduct a review of Bruce B against modern codes and standards and international safety expectations, and to provide input to a practicable set of improvements to be conducted during the MCR in Units 5 to 8, including U0B, and during asset management activities to support ongoing operation of all four units, that will enhance safety to support long term operation This specific objective has been met by the completion of the review tasks specific to emergency planning.

As noted in sections 4 and 5.1, a particular strength was noted in emergency preparedness as a result of changes related, or in follow-up, to the lessons learned from the Fukushima events.

Table 8 summarizes the key issues arising from the Integrated Safety Review of Safety Factor 13.

Table 8: Key Issues

Issue Number	Gap Description	Source(s)
SF13-1	Addressing existing expectations for the Emergency Management Program, the BPNERP, and/or implementing documents, specifically: • ERO Drill participation rate and staff selection; • MART response timing; • Completion of the On-Site/Off-Site Emergency Response Communications Project to ensure that two independent means of communication are available to all emergency centres; • ensuring security arrangements at off-site centres; • enhancements to recovery plan framework; and • Basis for minimum shift complement and ability to respond to multi-unit events.	Sections 5.1, 7.1, 7.2.1, 7.2.1.1 7.3.2.7, 7.4 Micro-gaps against requirement clauses: REGDOC-2.10.1 – Clause 2.1 REGDOC-2.10.1 – Clause 2.2.6 REGDOC-2.10.1 – Clause 2.2.8
SF13-2	Addressing the additional requirements in CSA N1600 and IAEA GSR Part 7.	Section 5.3.5 Micro-gaps against requirement

Issue Number	Gap Description	Source(s)
	There are a number of detailed additional requirements in CSA N1600 that would need to be addressed for the implementation of the current version of the standard. The more significant of these include: • an evaluation of losing critical functions, which might impact the ability to respond and recover from an emergency; • processes for deviating from emergency response plans or recovery plans; • detailed requirements for nuclear emergency recovery plans. There are also a number of additional requirements in IAEA GSR Part 7. The more significant of these include: • for emergency workers, increased fitness for duty expectations, training, medical follow-up and psychological counselling, optimized protection • process for authorizing exceeding dose limits and obtaining qualified medical advice prior to incurring additional occupational exposure • having sufficient qualified staff manage an emergency response at all facilities if each of the facilities is under emergency conditions simultaneously	clauses: CSA N1600 – Clause 4.2.3 CSA N1600 – Clause 4.5.2 CSA N1600 – Clause 4.5.12 CSA N1600 – Clause 4.6.1 CSA N1600 – Clause 5.4 IAEA GSR Part 7 – Clause 5.49 IAEA GSR Part 7 – Clause 5.52 IAEA GSR Part 7 – Clause 5.53 IAEA GSR Part 7 – Clause 5.57 IAEA GSR Part 7 – Clause 5.60 IAEA GSR Part 7 – Clause 6.11
SF13-3	Addressing issues raised by the 2015 OSART Review: • increasing the robustness of radiation protection for on-site personnel • improving procedural guidance emergency classification • improving the radiation protection for EMC staff	Sections 5.3.1, 5.3.2, 5.3.3, 5.3.5, 7.2.2.2 Microgaps as identified in the Bruce B OSART Report section 9

The overall conclusion is that, with the exceptions noted in Table 8, Bruce Power's programs meet the requirements of the Safety Factor related to Emergency Planning.

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

A.1. CSA N1600-14, General Requirements for Nuclear Emergency Management Programs

CSA N1600-14, 2014, General requirements for nuclear emergency management programs [37] is a new Canadian Standards Association (CSA) Standard issued in May 2014. This Standard provides requirements for a comprehensive nuclear emergency management (EM) program embracing the EM components (prevention/mitigation, preparedness, response, and recovery) in keeping with international EM practice, with a predominant focus on preparedness, response, and recovery. It establishes the elements of a continuous improvement process to develop, implement, maintain, and evaluate the EM functions of nuclear facilities and their surrounding communities. A high level review of this standard against the requirements of the CNSC REGDOC-2.1.10 [23] and CNSC REGDOC-2.3.2 [27] was performed to first identify any additional/revised requirements on licensees, and then to make a high level assessment of the Bruce emergency management programs against CSA N1600. This is shown in Table A1 below. It should be noted that in general, CSA N1600 has much more specific requirements; however they remain largely aligned with the requirements in the CNSC REGDOCs as they apply to Nuclear Power Plants (NPPs). In addition, it also contains extensive guidance. This has not been included in Table A1.

Additionally, the requirements in CSA N1600-14 are often applied to the “organization”, which is defined as including, but not limited to, NPPs, all levels of government, first responders, and non-governmental organizations. Hence the application of CSA N1600 would require agreement amongst the various organizational entities as to the extent and scope that a specific requirement applies to whom. For example, the requirements on protective actions are more appropriate to the provincial Emergency Response Organization (ERO), but this is not specified in the standard.

Table A1: High Level Review of CSA N1600-14

CSA N1600 Clause	Nature of Additional or Revised Requirements with respect to CNSC REGDOC-2.10.1 and CNSC REGDOC-2.3.2	Significance to Bruce Power Nuclear Emergency Planning
4.1.3	CSA N1600 requires participation in inter-organizational emergency management coordinating committees. CNSC REGDOC-2.10.1 does not cover this area.	None. Plan is in place.

CSA N1600 Clause	Nature of Additional or Revised Requirements with respect to CNSC REGDOC-2.10.1 and CNSC REGDOC-2.3.2	Significance to Bruce Power Nuclear Emergency Planning
4.1.4	CSA N1600 requires alternative means, measures, procedures, processes, approaches, or technologies to be approved by the Authority Having Jurisdiction prior to implementation. CNSC REGDOC-2.10.1 requires that licensees seek CNSC approval for changes only if the (mandatory) validating analysis reduces ER effectiveness. It is expected that minor or administrative changes be reported to the CNSC.	None.
4.2.3	CSA N1600 requires an evaluation of losing critical functions which might impact the ability to respond and recover from an emergency with the goal being to ensure continuity of the critical functions (critical functions cover more than equipment). There is no equivalent requirement in CNSC REGDOC-2.10.1. The latter requires identification of essential emergency response equipment, and a description of how their operation and effectiveness in an emergency are assured. In addition, CNSC REGDOC-2.3.2 requires demonstration with reasonable assurance that equipment and instrumentation used in severe accident management will survive and perform their required function.	Additional requirement. This is considered a gap.
4.2.6	CSA N1600 requires a documented review of the planning basis every five years. CNSC REGDOC-2.3.2 requires periodic and continuous review, but does not specify a minimum frequency.	None.
4.3.1, 4.3.8, 4.5.10	CSA N1600 requires a communication needs analysis and processes for various internal and external groups. CNSC REGDOC-2.10.1 requires descriptions of communications, notifications, interface agreements, and coordination.	None. Indirect compliance.
4.4.1, 4.4.4	CSA N1600 requires the establishment of a planning cycle and NEMP review committee. No such specific requirement exists in the CNSC REGDOCs.	None.
4.4.5	CSA N1600 requires a records management process for the organizations NEMP. No such requirement is specified in CNSC REGDOC-2.10.1.	None.

CSA N1600 Clause	Nature of Additional or Revised Requirements with respect to CNSC REGDOC-2.10.1 and CNSC REGDOC-2.3.2	Significance to Bruce Power Nuclear Emergency Planning
4.5.2, 4.5.12	CSA N1600 requires that the emergency response plan includes a process for deviation from the plan and who can authorize this. No such requirement is specified in CNSC REGDOC-2.10.1.	Additional Requirement. This is considered a gap against these clauses.
4.5.6.2, 4.5.6.4.3	CSA N1600 requires that the nuclear emergency response plan identify protective actions and injection control actions for the food chain as well as a process for rescinding such actions. Other than iodine thyroid blocking agents, no such requirement is specified in CNSC REGDOC-2.10.1.	Additional requirement. However, this appears to be provincial responsibility.
4.6.1	CSA N1600 has more detailed requirements for the development and content of nuclear emergency recovery plans in comparison to CNSC REGDOC-2.10.1.	Additional requirements. This is considered a gap.
4.10.8	CSA N1600 has detailed requirements for planning of exercise program evaluation in comparison to CNSC REGDOC-2.10.1.	None. Details are embedded in BP plan and implementing procedures.
5.4	CSA N1600 requires a process for deviating from a recovery plan, and who can authorize this. CNSC REGDOC-2.10.1 does not contain such requirements.	Additional requirement. This is considered a gap.

A.2. IAEA GSR Part 7, Preparedness and Response for a Nuclear or Radiological Emergency

IAEA GSR Part 7, Preparedness and Response for a Nuclear or Radiological Emergency, was issued by the International Atomic Energy Agency (IAEA) in 2015 to update IAEA GS-R-2, Preparedness and Response for a Nuclear or Radiological Emergency, issued in 2002. The update was prepared to take into account developments and experience gained since 2002, including experience gained from the response to the accident at the Fukushima Daiichi nuclear power plant and to recommendations of the International Commission on Radiological Protection (ICRP).

IAEA GS-R-2 was one of the References considered in formulating CNSC REGDOC-2.10.1. Both documents are primarily aimed at national governmental organizations to assist in setting out national requirements. Since IAEA GSR Part 7 is a new standard not considered in current REGDOCs, a high level review of fundamental changes from IAEA GS-R-2 with respect to requirements that would be imposed on operating organizations like Bruce Power is considered appropriate. This review is documented in Table A2 below and represents a high level review of fundamentally changed requirements only that would have clear impacts on Bruce Power's emergency planning. Where requirements are substantially unchanged, these have also been identified.

Note: In the clauses cited below, the Bruce Site would be considered to be a category I facility.

Table A2: High Level Review of IAEA GSR Part 7

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
4.16	The operating organization shall establish and maintain arrangements for on-site preparedness and response for a nuclear or radiological emergency for facilities or activities under its responsibility, in accordance with the applicable requirements.	None. Also, required by IAEA GS-R-2 Clause 8. Requirement met through BP's program, BPNERP, and implementing procedures and arrangements.
4.17	The operating organization shall demonstrate that, and shall provide the regulatory body with an assurance that, emergency arrangements are in place for an effective response on the site to a nuclear or radiological emergency in relation to a facility or an activity under its responsibility.	None. Also, implied by IAEA GS-R-2 Clause 8. LCH requires submission of changes to BP-PROG-08.01 and BP-PLAN-00001
5.14	The operating organization of a facility or activity in	None. Equivalent to IAEA

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
	category I, II, III or IV shall make arrangements for promptly classifying, on the basis of the hazard assessment, a nuclear or radiological emergency warranting protective actions and other response actions to protect workers, emergency workers, members of the public and, as relevant, patients and helpers in an emergency, in accordance with the protection strategy (see Requirement 5). This shall include a system for classifying all types of nuclear or radiological emergency as follows: (a) General emergency at facilities in category I or II for an emergency that warrants taking precautionary urgent protective actions, urgent protective actions, and early protective actions and other response actions on the site and off the site. Upon declaration of this emergency class, appropriate actions shall promptly be taken, on the basis of the available information relating to the emergency, to mitigate the consequences of the emergency on the site and to protect people on the site and off the site. (b) Site area emergency at facilities in category I or II for an emergency that warrants taking protective actions and other response actions on the site and in the vicinity of the site. Upon declaration of this emergency class, actions shall promptly be taken: (i) to mitigate the consequences of the emergency on the site and to protect people on the site; (ii) to increase the readiness to take protective actions and other response actions off the site if this becomes necessary on the basis of observable conditions, reliable assessments and/or results of monitoring; and (iii) to conduct off-site monitoring, sampling and analysis. (c) Facility emergency at facilities in category I, II or III for an emergency that warrants taking protective actions and other response actions at the facility and on the site but does not warrant taking protective actions off the site. Upon declaration of this emergency class, actions shall promptly be taken to mitigate the consequences of the emergency and to protect people at the facility and on the site. Emergencies in this class do not present an off-site hazard. (d) Alert at facilities in category I, II or III for an event that warrants taking actions to assess and to mitigate the	GS-R-2 Clause 4.19. BP-PLAN-00001 Appendix B identifies five “provincial notification categories” following a station emergency, which are mandated by the Provincial Nuclear Emergency Plan. These are: - liquid emission - general emergency - on-site emergency - abnormal incident - reportable event The intent is thus met.

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
	potential consequences at the facility. Upon declaration of this emergency class, actions shall promptly be taken to assess and to mitigate the potential consequences of the event and to increase the readiness of the on-site response organizations. (e) Other nuclear or radiological emergency for an emergency in category IV that warrants taking protective actions and other response actions at any location. Upon declaration of this emergency class and the level of emergency response, actions shall promptly be taken to mitigate the consequences of the emergency on the site, to protect those in the vicinity (e.g. workers and emergency workers and the public) and to determine where and for whom protective actions and other response actions are warranted.	
5.15	For facilities in category I, II or III and for category IV, arrangements shall be made to review the declared emergency class in the light of any new information and, as appropriate, to revise it.	None. Implied in IAEA GS-R-2 Clause 4.24(b). Implicit in BP-PLAN-00001 and the role of the EMC.
5.16	The emergency classification system for facilities and activities in categories I, II, III and IV shall take into account all postulated emergencies, including those arising from events of very low probability. The operational criteria for classification shall include emergency action levels and other observable conditions (i.e. 'observables') and indicators of the conditions at the facility and/or on the site or off the site. The emergency classification system shall be established with the aim of allowing for the prompt initiation of an effective response in recognition of the uncertainty of the available information. It shall be ensured that any process for rating an event on the International Nuclear and Radiological Event Scale (INES) does not delay the emergency classification or emergency response actions.	None. Clarification of IAEA GS-R-2 Clause 4.20. Declarations are independent of initiating events. Notification categories are ties to required response.
5.23	The operating organization of a facility or activity in category I, II, III or IV shall promptly decide on and take actions on the site that are necessary to mitigate the consequences of a nuclear or radiological emergency involving a facility or an activity under its responsibility.	None. Equivalent to IAEA GS-R-2 Clause 4.25. This is defined by the BP-PLAN-00001

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
5.25	For facilities in category I, II or III, arrangements shall be made for mitigatory actions to be taken by the operating personnel, in particular: (a) To prevent escalation of an emergency; (b) To return the facility to a safe and stable state; (c) To reduce the potential for, and to mitigate the consequences of, radioactive releases or exposures These arrangements shall take into account the full range of possible conditions affecting the emergency response, including those resulting from conditions in the facility and those resulting from impacts of postulated natural, human induced or other events and affecting regional infrastructure or affecting several facilities simultaneously. Arrangements shall include emergency operating procedures and guidance for operating personnel on mitigatory actions for severe conditions (for a nuclear power plant, as part of the accident management programme and for the full range of postulated emergencies, including accidents that are not considered in the design and associated conditions. As far as practicable, the continued functionality of nuclear security system(s) needs to be considered in these arrangements.	None. Extension of IAEA GS-R-2 Clause 4.39 with the additional expectation on impact on security arrangements. However, the latter is addressed implicitly in IAEA GS-R-2 Clause 5.16. Emergency procedures, including Abnormal Incident Manuals (AIMs), Emergency Mitigating Equipment Guidance (EMEGs), and Severe Accident Management Guidance (SAMG) address this clause.
5.26	The operating organization of a facility or activity in category I, II, III or IV shall assess and determine, at the preparedness stage, when and under what conditions assistance from off-site emergency services may need to be provided on the site, consistent with the hazard assessment and the protection strategy.	None. Implied in IAEA GS-R-2 Clause 4.35.
5.27	For facilities in category I, II or III, arrangements shall be made, in particular by the operating organization, to provide technical assistance to the operating personnel. On-site teams for mitigating the consequences of an emergency (e.g. damage control, firefighting) shall be available and shall be prepared to perform actions at the facility. Paragraph 5.15 of Safety of Nuclear Power Plants: Design (SSR-2/1) [18] states that: "Any equipment that is necessary for actions to be taken in manual response and recovery processes shall be placed at the most suitable location to ensure its	None. Included in IAEA GS-R-2 Clause 4.40. Shift Emergency controller/ Emergency Management Centre (EMC) Commander marshal station EROs and external resources respectively. The EMC provides operating personnel with additional resources and

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
	availability at the time of need and to allow safe access to it under the environmental conditions anticipated." The operating personnel directing mitigatory actions shall be provided with information and technical assistance to allow them to take actions effectively to mitigate the consequences of the emergency. Arrangements shall be made to obtain support promptly from the emergency services (e.g. law enforcement agencies, medical services and firefighting services) off the site. Off-site emergency services shall be afforded prompt access to the facility, and shall be informed of on-site conditions and provided with instructions and with means for protecting themselves as emergency workers.	technical assistance.
5.32	The operating organization of a facility in category I, II or III shall make arrangements to promptly assess and anticipate: (a) Abnormal conditions at the facility; (b) Exposures and radioactive releases and releases of other hazardous material; (c) Radiological conditions on the site and, as appropriate, off the site; (d) Any exposures or potential exposures of workers and emergency workers, the public and, as relevant, patients and helpers in an emergency.	None. Included in IAEA GS-R-2 Clause 4.69, 4.70, with the addition of "helpers". Habitability assessments for Beyond Design Basis Accidents (BDBAs) have been completed (e.g., NK29-CORR-00531-12635).
5.33	These assessments as stated in para. 5.32 shall be used: (a) For deciding on mitigatory actions to be taken by the operating personnel; (b) As a basis for emergency classification (see para. 5.14); (c) For deciding on protective actions and other response actions to be taken on the site, including those for the protection of workers and emergency workers; (d) For deciding on protective actions and other response actions to be taken off the site; (e) Where appropriate, to identify those individuals who could potentially have been exposed on the site at levels requiring appropriate medical attention in accordance with	None. Included in IAEA GS-R-2 Clause 4.70, 4.71. Habitability assessments for BDBA have been completed (e.g., NK29-CORR-00531-12635).

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
	Appendix II.	
5.34	These arrangements as stated in para. 5.32 shall include the use of pre-established operational criteria in accordance with the protection strategy (see para. 4.28(4)) and provision for access to instruments displaying or measuring those parameters that can readily be measured or observed in a nuclear or radiological emergency. In these arrangements, the expected response of instrumentation and of structures, systems and components at the facility under emergency conditions shall be taken into account.	None. Partly included in Included in IAEA GS-R-2 Clause 4.70. In addition, SAMG identifies those parameters required to be monitored. Instrument and Equipment survivability studies ensure the availability of required instrumentation. In addition, Bruce Power has installed off site real-time radiological monitoring instrumentation.
5.41	The operating organization of a facility in category I, II or III shall make arrangements to ensure protection and safety for all persons on the site in a nuclear or radiological emergency. These shall include arrangements to do the following: (a) To notify all persons on the site of an emergency on the site; (b) For all persons on the site to take appropriate actions immediately upon notification of an emergency; (c) To account for those persons on the site and to locate and recover those persons unaccounted for; (d) To provide immediate first aid; (e) To take urgent protective actions.	None. Per BP-PLAN-00001, emergency notification and activation and ERO assembly and response address this requirement.
5.42	Arrangements as stated in para. 5.41 shall also include ensuring the provision, for all persons present in the facility and on the site, of: (a) Suitable assembly points, provided with continuous radiation monitoring; (b) A sufficient number of suitable escape routes; (c) Suitable and reliable alarm systems and other means for warning and instructing all persons present under the	None. Per BP-PLAN-00001, Emergency notification and activation and ERO assembly and response address this requirement.

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
	full range of emergency conditions.	
5.43	The operating organization of a facility in category I, II or III shall ensure that suitable, reliable and diverse means of communication are available at all times, under the full range of emergency conditions, for use in taking protective actions and other response actions on the site and for communication with off-site officials responsible for taking protective actions and other response actions off the site or within any emergency planning zones or emergency planning distances.	None. Per BP-PLAN-00001, a number of communications channels are provided.
5.49	Arrangements shall be made to ensure that emergency workers are, to the extent practicable, designated in advance and are fit for the intended duty. These arrangements shall include health surveillance for emergency workers for the purpose of assessing their initial fitness and continuing fitness for their intended duties.	New clause. Fitness for duty is currently addressed through various station programs for all staff. However, these are considered increased expectation. It is also noted that Draft REGDOC-2.2.4, Human Performance Management - Fitness for Duty, was issued by the CNSC in November 2015. Assessed as a compliance gap.
5.51	The operating organization and response organizations shall determine the anticipated hazardous conditions, both on the site and off the site, in which emergency workers might have to perform response functions in a nuclear or radiological emergency in accordance with the hazard assessment and the protection strategy.	None. Equivalent to IAEA-GS-R-2 clause 4.61.
5.52	The operating organization and response organizations shall ensure that arrangements are in place for the protection of emergency workers and protection of helpers in an emergency for the range of anticipated hazardous conditions in which they might have to perform response functions. These arrangements, as a minimum, shall include: (a) Training those emergency workers designated as such	New clause. Note that for (f), the Emergency Task Briefing Form, FORM-10083, has been revised to include a section where the worker is briefed and signs their agreement. (g) is assessed as a

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
	in advance; (b) Providing emergency workers not designated in advance and helpers in an emergency immediately before the conduct of their specified duties with instructions on how to perform the duties under emergency conditions ('just in time' training); (c) Managing, controlling and recording the doses received; (d) Provision of appropriate specialized protective equipment and monitoring equipment; (e) Provision of iodine thyroid blocking, as appropriate, if exposure due to radioactive iodine is possible; (f) Obtaining informed consent to perform specified duties, when appropriate; (g) Medical examination, longer term medical actions and psychological counselling, as appropriate.	compliance gap.
5.53	The operating organization and response organizations shall ensure that all practicable means are used to minimize exposures of emergency workers and helpers in an emergency in the response to a nuclear or radiological emergency (see para. I.2 of Appendix I), and to optimize their protection.	New clause. Assessed as a compliance gap as currently no means to demonstrate "all practicable means…" and "optimize their protection".
5.54	In a nuclear or radiological emergency, the relevant requirements for occupational exposure in planned exposure situations established in GSR Part 3 [8] shall be applied, on the basis of a graded approach, for emergency workers, except as required in para. 5.55.	Per BP-PLAN-00001, process for emergency exposure limits is specified in section 4.2.1.3.
5.55	The operating organization and response organizations shall ensure that no emergency worker is subject to an exposure in an emergency that could give rise to an effective dose in excess of 50 mSv other than: (1) For the purposes of saving human life or preventing serious injury; (2) When taking actions to prevent severe deterministic effects or actions to prevent the development of catastrophic conditions that could significantly affect people and the environment;	None. Addressed by the Radiation Protection Regulations. Also, assessed by plant habitability studies.

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
	(3) When taking actions to avert a large collective dose.	
5.57	The operating organization and response organizations shall ensure that emergency workers who undertake emergency response actions in which doses received might exceed an effective dose of 50 mSv do so voluntarily; that they have been clearly and comprehensively informed in advance of associated health risks as well as of available protective measures; and that they are, to the extent possible, trained in the actions that they might be required to take. Emergency workers not designated as such in advance shall not be the first emergency workers chosen for taking actions that could result in their doses exceeding the guidance values of dose for lifesaving actions, as given in Appendix I. Helpers in an emergency shall not be allowed to take actions that could result in their receiving doses in excess of an effective dose of 50 mSv.	Addressed to a certain extent by Appendix I of IAEA GS-R-2. Currently these are not clear criteria for authorizing exceeding dose limits in the Emergency Preparedness Program and supporting documentation. This is considered a gap.
5.58	Arrangements shall be made to assess as soon as practicable the individual doses received in a response to a nuclear or radiological emergency by emergency workers and helpers in an emergency and, as appropriate, to restrict further exposures in the response to the emergency (see Appendix I).	None. Equivalent to IAEA GS-R-2 Clause 4.62.
5.59	Emergency workers and helpers in an emergency shall be given appropriate medical attention for doses received in a response to a nuclear or radiological emergency (see Appendix II) or at their request.	None. Addressed in IAEA GS-R-2 Clause 4.74.
5.60	Emergency workers who receive doses in a response to a nuclear or radiological emergency shall normally not be precluded from incurring further occupational exposure. However, qualified medical advice shall be obtained before any further occupational exposure occurs if an emergency worker has received an effective dose exceeding 200 mSv, or at the request of the emergency worker.	Obtaining qualified medical advice is a change from IAEA-GS-R-2, and is currently not included in the Emergency Preparedness Program and supporting documentation. This is considered a gap.
5.61	Information on the doses received in the response to a nuclear or radiological emergency and information on any consequent health risks shall be communicated, as soon as practicable, to emergency workers and to helpers in an	None. Retains intent of IAEA-GS-R-2 clause 4.64.

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
	emergency.	
6.11	For a site where multiple facilities in category I or II are co-located, an appropriate number of suitably qualified personnel shall be available to manage an emergency response at all facilities if each of the facilities is under emergency conditions simultaneously (see para. 5.4).	New requirement. As long as the scope of the multi-unit emergency staffing requirement and minimum staffing complement is unresolved (e.g., NK29-CORR-00531-12798), this is identified as a gap.
6.19	The operating organization of a facility or for an activity in category I, II, III or IV shall prepare an emergency plan. This emergency plan shall be coordinated with those of all other bodies that have responsibilities in a nuclear or radiological emergency, including public authorities, and shall be submitted to the regulatory body for approval.	None. Addressed in IAEA GS-R-2 Clause 5.19. Addressed by BP-PLAN-00001.
6.20	The operating organization and response organizations shall develop the necessary procedures and analytical tools to be able to perform the functions specified in Section 5 for the goals of emergency response to be achieved and for the emergency response to be effective.	None. IAEA GS-R-2 Clause 5.21. Overall requirement met by BP-PROG-08.01 and implementing processes.
6.21	Procedures and analytical tools shall be tested under simulated emergency conditions and shall be validated prior to initial use. Any arrangements for the use of analytical tools early in an emergency response for supporting decision making on protective actions and other response actions shall be made in due recognition of the limitations of such analytical tools and in a way that would not reduce the effectiveness of response actions. These limitations shall be made clear to, and shall be recognized by, those responsible for decision making.	None. Expansion and clarification of IAEA GS-R-2 Clause 5.22.
6.22	Adequate tools, instruments, supplies, equipment, communication systems, facilities and documentation (such as documentation of procedures, checklists, manuals, telephone numbers and email addresses) shall be provided for performing the functions specified in Section 5. These items and facilities shall be selected or designed to be operational under the conditions (such as radiological conditions, working conditions and environmental conditions) that could be encountered in the emergency	None. Addressed in IAEA GS-R-2 Clause 5.22.

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
	response, and to be compatible with other procedures and equipment for the response (e.g. compatible with the communication frequencies used by other response organizations), as appropriate. These support items shall be located or provided in a manner that allows their effective use under the emergency conditions postulated.	
6.23	For facilities in categories I and II, as contingency measures, alternative supplies for taking on-site mitigatory actions, such as an alternative supply of water and an alternative electrical power supply, including any necessary equipment, shall be ensured. This equipment shall be located and maintained so that it can be functional and readily accessible when needed (see also Safety of Nuclear Power Plants: Design (SSR-2/1).	None. Addressed by FAI upgrades.
6.25	For facilities in category I, emergency response facilities39 separate from the control room and supplementary control room shall be provided so that: (a) Technical support can be provided to the operating personnel in the control room in an emergency (from a technical support centre). (b) Operational control by personnel performing tasks at or near the facility can be maintained (from an operational support centre). (c) The on-site emergency response is managed (from an emergency centre). These emergency response facilities shall operate as an integrated system in support of the emergency response, without conflicting with one another's functions, and shall provide reasonable assurance of being operable and habitable under a range of postulated hazardous conditions, including conditions not considered in the design.	None. Clarification of IAEA GS-R-2 Clause 5.27. Addressed by EMC.
6.26	Arrangements shall be made for performing appropriate and reliable analyses of samples and measurements of internal contamination for the purposes of emergency response and of health screening, as appropriate. Such arrangements shall include the designation of laboratories that would be operational under postulated emergency	None. Clarification of IAEA GS-R-2 Clause 5.28.

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
	conditions.	
6.28	The operating organization and response organizations shall identify the knowledge, skills and abilities necessary to perform the functions specified in Section 5. The operating organization and response organizations shall make arrangements for the selection of personnel and for training to ensure that the personnel selected have the requisite knowledge, skills and abilities to perform their assigned response functions. The arrangements shall include arrangements for continuing refresher training on an appropriate schedule and arrangements for ensuring that personnel assigned to positions with responsibilities in an emergency response undergo the specified training.	None. IAEA GS-R-2 Clause 5.31. Overall requirement met by BP-PROG-08.01 and implementing processes.
6.29	For facilities in category I, II or III, all personnel and all other persons on the site shall be instructed in the arrangements for them to be notified of an emergency and of their actions if notified of an emergency.	None. IAEA GS-R-2 Clause 5.32.
6.30	Exercise programmes shall be developed and implemented to ensure that all specified functions required to be performed for emergency response, all organizational interfaces for facilities in category I, II or III, and the national level programmes for category IV or V are tested at suitable intervals. These programmes shall include the participation in some exercises of, as appropriate and feasible, all the organizations concerned, people who are potentially affected, and representatives of news media. The exercises shall be systematically evaluated (see para. 4.10(h)) and some exercises shall be evaluated by the regulatory body. Programmes shall be subject to review and revision in the light of experience gained (see paras 6.36 and 6.38).	None. IAEA GS-R-2 Clause 5.33. Overall requirement met by BP-PROG-08.01 and implementing processes.
6.31	The personnel responsible for critical response functions shall participate in drills and exercises on a regular basis so as to ensure their ability to take their actions effectively.	None. IAEA GS-R-2 Clause 5.34.
6.32	Officials off the site who are responsible for making decisions on protective actions and other response actions shall be trained and shall regularly participate in exercises. Officials off the site who are responsible for communication with the public in a nuclear or radiological emergency shall	None. IAEA GS-R-2 Clause 5.35.

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
	regularly participate in exercises.	
6.33	The conduct of exercises shall be evaluated against pre-established objectives of emergency response to demonstrate that identification, notification, activation and response actions can be performed effectively to achieve the goals of emergency response (see para. 3.2).	None. IAEA GS-R-2 Clause 5.36.
6.34	The operating organization, as part of its management system, and response organizations, as part of their emergency management system, shall establish a programme to ensure the availability and reliability of all supplies, equipment, communication systems and facilities, plans, procedures and other arrangements necessary to perform functions in a nuclear or radiological emergency as specified in Section 5 (see para. 6.22). The programme shall include arrangements for inventories, resupply, tests and calibrations, to ensure that these are continuously available and are functional for use in a nuclear or radiological emergency.	None. Rewriting of IAEA GS-R-2 Clause 5.37. Overall requirement met by BP-PROG-08.01 and implementing processes.
6.35	The programme shall also include periodic and independent appraisals against functions as specified in Section 5, including participation in international appraisals.	New. Overall requirement met by BP-PROG-08.01 and implementing processes.
6.36	Arrangements shall be made to maintain, review and update emergency plans, procedures and other arrangements and to incorporate lessons from research, operating experience (such as in the response to emergencies) and emergency exercises.	None. Included in IAEA GS-R-2 Clause 5.37.
6.37	The operating organization and response organizations shall establish and maintain adequate records in relation to both emergency arrangements and the response to a nuclear or radiological emergency, to include dose assessments, results of monitoring and inventory of radioactive waste managed, in order to allow for their review and evaluation. These records shall also provide for the identification of those persons requiring longer term medical actions, as necessary, and shall provide for the long term management of radioactive waste.	New. Overall requirement met by BP-PROG-08.01 and implementing processes.

IAEA GSR Part 7 Clause	Requirement in IAEA GSR Part 7 Relevant to the Operating Organization	Assessment Against IAEA GS-R-2 & Significance to Bruce Power Nuclear Emergency Planning
6.38	The operating organization and response organizations shall make arrangements to review and evaluate responses in actual events and in exercises, in order to record the areas in which improvements are necessary and to ensure that the necessary improvements are made.	None. Included in IAEA GS-R-2 Clause 5.39.

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 Periodic Safety Review (PSR) Basis Document 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 PSR 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 PSR 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 includes 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-2.10.1, Nuclear Emergency Preparedness and Response

In support of the review tasks listed in Section 5, a detailed assessment of REGDOC-2.10.1 has been performed in Table B1.

Table B1: CNSC REGDOC-2.10.1, Nuclear Emergency Preparedness and Response

Article No.	Clause Requirement	Assessment	Compliance Category
2.	An effective EP program is based on the following four components: 1. Planning basis: an analysis of the risks and hazards that the EP program will address 2. Emergency response plan and procedures: a comprehensive description of how a response will be executed, with accompanying support material 3. Preparedness: the processes to ensure that people, equipment and infrastructure will be ready to execute a response according to the emergency response plan and procedures 4. Program management: the management system aspects that assure the effectiveness of the EP program Licensed organizations with an existing EP program that address other corporate needs are encouraged to use this infrastructure to meet the requirements in this document. Key components and overlapping provisions of an EP	BP-PLAN-00001 (BPNERP) was issued in April of 2014 and takes into account the requirements in G-225, the latter having since been superseded by CNSC REGDOC-2.10.1 - Nuclear Emergency Preparedness and Response. The Bruce Power Nuclear Emergency Response Plan (BPNERP) addresses emergency preparedness, response and mitigation requirements. The BPNERP predominantly deals with releases of radioactive materials from fixed facilities. It describes the concepts, structures, roles, and processes needed to implement and maintain Bruce Power's capability to prepare for and to respond to a nuclear radiological emergency. The Plan outlines the command, control, and coordination structure and activities, activation, site integration, external agency coordination, deployment of emergency resources, and emergency facilities through the use Emergency Response Procedures developed to guide effectively trained emergency response staff in emergency response and mitigation techniques.	C

Article No.	Clause Requirement	Assessment	Compliance Category
	program and integrated accident management program are illustrated in Appendix A.		
2.1	All licensees shall: 1. establish a planning basis for their EP program 2. ensure the planning basis considers the hazards that have, or could have, an adverse impact on the environment and the health and safety of onsite personnel or the public, and also consider: a. all accidents and internal or external events that have been analyzed as having an unacceptable impact on their facilities b. the inclusion of multi-unit accidents scenarios for multi-unit power reactor facilities c. extended loss of power 3. use the results from the planning basis to determine the scope and depth of EP program requirements Additional requirements for licensees of reactor facilities with a thermal capacity greater than 10 MW. These licensees shall: 4. provide regional and provincial offsite authorities with necessary information to allow for effective emergency planning policies and procedures to be	Sub-clauses 1-3 are addressed as follows: The planning basis for the Emergency Plan (EP) program is established though BP-PROG-08.01, taking an all hazards approach, and is based on a requirement to sustain response without external assistance for a minimum of 72 hours in the event of loss of grid or prolonged ac power outage. Risks are constantly under review through a corporate risk log process. Hazard identification, risk assessment and impact analysis to determine planning requirements are conducted a minimum of every five years, or when deemed by the Emergency Management Oversight Committee or the CNSC. However, Severe Accident Management Guidance (SAMG) implementation that will input the planning basis to cater to a wider range of multi-unit severe accidents is in progress. Also, an upgrade to the Emergency Response Plan (ERP) code to allow multi-unit dose projection modeling capability remains in progress. These are considered to be gaps. With respect to sub-clause 4, the Bruce Power Nuclear Emergency Response Plan, BP-PLAN-00001, provides off-site authorities the necessary information for effective emergency planning policies and procedures to be established and modified, if needed, periodically.	Gap

Article No.	Clause Requirement	Assessment	Compliance Category
	established and modified, if needed, periodically Guidance Guidance for all licensees A nuclear emergency may be caused by, or involve, different types of hazards, including natural incidents (e.g., flooding, tornadoes, tsunami, ice or snowstorms, forest fires) and equipment malfunctions (identified within the design basis and beyond design basis). All hazards that cannot be practically eliminated with possible initiating and propagating pathways should be identified within the planning basis. Response to criminal and malicious activity may be dealt with under a separate program. The planning basis should be based on a full range of postulated scenarios that may challenge the facility's emergency response capabilities. This should include scenarios that involve a nuclear or radiological emergency combined with a conventional emergency, such as an earthquake or forest fire. A detailed analysis may be used to determine scenarios that can be practically eliminated. Plans should be developed for those scenarios that cannot be practically eliminated. Inputs to be considered in the analysis should include: the licensee's safety analysis,		

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	probabilistic safety analysis, and operating experience. Additional guidance for licensees of reactor facilities with a thermal capacity greater than 10 MW The information to be provided to regional and provincial offsite authorities should give all necessary details to make informed decisions on the size of emergency planning zones and the level of preparedness required. The necessary information should include: • possible accidents that cannot be practically eliminated • an estimate of the probability of such accidents occurring • an estimate of the associated radiological consequences, including isotopic release quantities, possible release start time and duration and the geographical area potentially affected Federal authorities would be provided emergency planning information through the CNSC.		
2.2	All licensees shall:	The Bruce Power Nuclear Emergency Response Plan, BP-PLAN-00001, and supporting Emergency	C

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	Develop and maintain emergency response (ER) plan(s) with supporting emergency response procedures. The ER plan shall be based on the planning basis as described in section 2.1 of this document. The ER plan shall identify and describe the methods that licensees use to respond to emergencies. This includes, but is not limited to, the following areas: 1. emergency response organization and staffing 2. emergency categorization, activation and notification 3. emergency assessment 4. offsite response organizations interface and support 5. emergency personnel protection 6. emergency response facilities and equipment 7. emergency information and public communications 8. recovery 9. validation of the ER plan and procedures Guidance	Response Procedures, describe the methods Bruce Power uses to respond to an emergency and has the attributes described in the clause requirements.	

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	Guidance for all licensees The ER plan, which may consist of one or several documents, incorporates pertinent information directly or by reference. Plan content can vary to accommodate facility-specific needs and circumstances based on risk. The ER plan may incorporate emergency preparedness and response procedures directly, or it may reference pertinent documents, such as the facility procedures manual(s). If referenced, the documents should be immediately accessible. Procedures are used to define the necessary steps and/or requirements for various emergency preparedness and response processes and activities. Licensees should also consult RD/GD-99.3, Public Information and Disclosure, concerning public disclosure protocols regarding events and developments at their facilities.		
2.2.1	All licensees shall: In accordance with the ER plan and procedures: 1. establish an emergency response organization	1. The integrated emergency response organization is described in section 7 of the Bruce Power Nuclear Emergency Response Plan (BP-PLAN-00001 R005) as consisting of two primary components - the duty Shift ERO, and the on-call Emergency Management	C

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	(ERO) with a command structure that is clearly defined and integrated 2. define and document the minimum number of staff required to maintain the ERO and their qualifications 3. define the expected reporting times for the ERO to report to the emergency response facility or designated area (see section 2.2.6 of this document) after it has been alerted to respond 4. document the requirement to maintain and retain logs of all actions, orders, and track and update actions throughout the emergency Additional requirements for licensees of reactor facilities with a thermal capacity greater than 10 MW. These licensees shall: 5. define and document how the ERO staffing will be maintained and monitored to ensure the minimum shift complement is available at the nuclear facility at all times 6. define and document how licensees will maintain the ERO extended response over multiple shifts Guidance	Centre (EMC), to address station and site support. 2. The minimum number of staff, their roles and responsibilities, and communication interfaces is also described in section 7 of the Bruce Power Nuclear Emergency Response Plan (BP-PLAN-00001) (Table 1). Qualifications are addressed in TQD-00005. 3. The shift emergency controller (SEC), the senior authorized person on shift, assumes command and control of the shift ERO on declaration of an emergency, until it is transferred to the Emergency Management Centre Commander (section 4.2.1). The on-call EMC key staff are targeted to assemble within 90 minutes of notification (section 7.2.1.3 of the Bruce Power Nuclear Emergency Response Plan). 4. The requirement to maintain and retain logs is identified in Bruce Power Nuclear Emergency Response Plan under the various organizational descriptions in section 7.2.1.1, and 7.2.1.4. For the Shift ERO, the Emergency Shift Assistant maintains the SEC log. Within the EMC the Site Ops Logger has this responsibility. 5. BP-PROC-00011, Emergency Response Organization, Staffing, and Availability, provides the process to ensure on-call ERO staff is selected, trained and qualified. On-duty staff is managed through the minimum shift complement process. 6. The Logistics Section Chief is responsible for site logistics, including additional staffing call-ins and shift change coordination (section 7.2.1.4 of the BPNERP).	

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	Guidance for all licensees An indication of an effective ERO is the demonstration of clear command and control over the emergency response. It should be clearly understood who is in charge and with whom final decisions and authorities lie. The ERO should be adaptable and flexible, so as to be able to manage an incident as it evolves or as its circumstances change rapidly or abruptly. Procedures should be in place to ensure: • clear roles and responsibilities and authorities of each ERO position • timely and adequate onsite and offsite communication • periodic update and turnover briefings • decisions documented in event logs • effective and clear communication Appropriate arrangements should be identified for shift turnover and provision of food and other amenities for prolonged duty caused by beyond design basis initiating events. Additional guidance on the number of staff required to maintain the ERO and their qualifications can be found		

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	in CNSC regulatory document G-323, Ensuring the Presence of Sufficient Qualified Staff at Class I Nuclear Facilities – Minimum Staff Complement. Licensees should also consult G-274, Security Programs for Category I or II Nuclear Material or Certain Nuclear Facilities, for further information regarding security aspects of emergency preparedness and response. Additional guidance for licensees of reactor facilities with a thermal capacity greater than 10 MW Members of mobile offsite survey teams need not be accounted for as part of the minimum complement for facilities equipped with real-time fixed radiological detection and monitoring capabilities, if the licensee makes provisions for immediate mobilization of offsite survey teams upon activation of the ERO. Licensees should also consult REGDOC-2.12.1, High-Security Sites: Nuclear Response Force.		
2.2.2	All licensees shall: Have an ER plan and procedures that: 1. describe the complete set of conditions that would	Each sub-clause is addressed as follows: 1. Conditions for definition of a station emergency and thus activation of the ERO are defined in the Bruce Power Nuclear Emergency Response Plan (BP-PLAN-00001) section 4.2.2.1. In addition, various	AD

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	require activation of the ERO 2. describe how unusual events, incidents and emergencies are to be determined and classified to initiate onsite response; the same notification categories and standard definitions used by offsite authorities shall be used and/or cross-referenced 3. describe the immediate notification process and secondary communication methods to alert all onsite personnel, to initiate personnel assembly and accounting, and to activate the ERO and associated emergency response and support facilities 4. define organizational methods, processes, timelines and emergency levels to notify the appropriate personnel and authorities 5. describe all offsite notification requirements and any time requirements that apply, ensuring that: a. the description includes identification of the appropriate positions, by title and agency, of the provincial, territorial and local government agencies b. offsite authorities are notified within 15 minutes of categorizing the event Additional requirement for all Class I facilities: ensure the CNSC is notified within 15 minutes of activation of the ERO. Guidance	AIMs (e.g., Loss of Coolant Accident (LOCA), steam line break, Main Control Room (MCR) uninhabitable), also require the declaration of a station emergency. 2. Section 4.2.2.1 of the Bruce Power Nuclear Emergency Response Plan (BP-PLAN-00001) outlines the use of an emergency tone to classify the station emergency, as well as the Provincial Notification Category (described in Appendix F of the BPNERP) which is based on the Provincial Nuclear Emergency response Plan. 3.,4.,5. Section 4.2.2.2 of the BPNERP defines the initial and secondary notification processes. Offsite provincial authorities are notified within 15 minutes after categorization, on a "best effort" basis, followed by municipal agency notifications. The CNSC notification target time is within 30 minutes on a best effort basis, after provincial and municipal agencies. This is considered an acceptable deviation as the CNSC has accepted the BPNERP.	

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	Guidance for all licensees Criteria that define when the ERO should be activated should be clearly documented. Licensees should follow provincial requirements, or when none exist, use the following categories, listed in order of increasing significance, to categorize various events: • reportable event: an event affecting the nuclear facility that would be of concern to the offsite authorities responsible for public safety • abnormal incident: an abnormal occurrence at the nuclear facility that may have a significant cause and/or may lead to more serious consequences • site area emergency: a serious malfunction that results or may result in an emission at a later time • general emergency: an ongoing atmospheric emission of radioactive material, or one likely within a short time frame, as a result of a more severe accident While item 5b above requires licensees to notify the offsite authorities within 15 minutes of event categorization, ideally such notification should be done as soon as possible. It is critical that the CNSC and offsite authorities be advised within the identified timeframes. The only acceptable exception to the requirement would be when immediate action was required to prevent a catastrophic incident from		

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	occurring.		
2.2.3	All licensees shall: In accordance with ER plans and procedures: 1. describe the methods and procedures to continually assess the emergency and predict both onsite and offsite conditions and parameters 2. continuously take appropriate measures to protect onsite personnel 3. continually characterize the magnitude of the offsite risk to the public and the environment 4. continually provide updates on a regular basis to offsite authorities and the CNSC Additional requirements for licensees of reactor facilities with a thermal capacity greater than 10 MW. These licensees shall: 5. have real-time fixed radiological detection and monitoring capabilities around the nuclear facility perimeter with appropriate backup power, and shall communicate results to offsite authorities and the CNSC 6. have sufficient capacity and capability for offsite radiological monitoring, including mobile offsite survey teams, and report results to the offsite response	1,2,3,4. Section 4.2.2.6 of BP-PLAN-00001 refers to Appendix C implementing procedures (section 7B) which address assessing the emergency and predicting off-site consequences. Section 4.2.2.7 refers to the BERP (Bruce Emergency Response Projection) code (run in parallel by the province) to assess airborne release dose projection estimates. Hourly data is transmitted to off-site authorities by the Shift Emergency Controller (SEC) and the Emergency Management Centre (EMC) when responsibility is transferred to it (Section 7.2.1 of BP-PLAN-00001). 5. There is no mention of the requirement for real time fixed radiological equipment in BP-PLAN-00001, or referenced documents, DIV-EM-00006, Emergency Off-site Radiological Monitoring Process for Airborne Releases of Radioactive Materials. The requirement for real time fixed radiological detection was also identified as a Fukushima Action Item (AI 1307-3793) and has been implemented (see NK21-CORR-00531-11379/NK29-CORR-00531-11782, NK21-CORR-00531-11644/NK29-CORR-00531-12030). In addition, per NK29-CORR-00531-12635, additional work, which goes beyond the scope of the original requirements, is being completed to install 8 air particulate monitors in 04 of 2015. These air samplers will augment the existing Bruce Power Environmental Tritium air monitors in order to provide more detailed data in terms of airborne and ground deposition. This	IC

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	authorities and the CNSC 7. promptly and continuously assess and determine source term estimate, plume dispersion and dose modeling, and report results to the offsite authorities and the CNSC 8. promptly and continuously estimate dose to the public based on source term estimation, plume dispersion and dose modeling, and provide the dose estimates to offsite response authorities and the CNSC Guidance Guidance for all licensees Emergency assessment, including categorization, is performed to determine: • the onsite response and staff mobilization required to protect onsite personnel and equipment • the notification category necessary for the provincial or territorial authorities to determine the required offsite response to protect the public and the environment Licensees should describe the methods and	is considered as indirect compliance. 6, 7, 8, are adequately addressed by the shift ERO complement and as needed augmentation, use of survey teams and health physics lab analysis, periodic reporting to off-site agencies, and use of public dose prediction programs (BERP). Note however, that improvements to the BERP to allow multi-unit dose projections, as communicated in NK29-CORR-00531-12635 and in Bruce Power's transition plan for full compliance with REGDOC-2.10.1 (NK29-CORR-00531-12566), remain in progress with a scheduled completion date of end of 2016.	

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	procedures for continual assessment of the following pertinent conditions and parameters: • the status, integrity and stability of the affected facilities and their components • identification, quantities, concentrations, or release rates of radiation, contaminants or other hazardous substances • onsite and offsite impacts on or threats to health, safety and the environment • location and direction of radioactive plumes or other emissions • loss of instrumentation Additional guidance for licensees of reactor facilities with a thermal capacity greater than 10 MW Source term sampling and estimation should be determined and reported to the CNSC on an hourly basis, upon determination and compilation of the data in a format approved by the provincial authority.		
2.2.4	All licensees shall: In accordance with ER plans and procedures: 1. establish plans and procedures to coordinate	Clause 2.2.4 is met by the BPNERP processes and its on-going review. While there is no explicit requirement in the BNERP or implementing to providing recommendations to off-site authorities on required protective actions, such recommendations	IC

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	response activities with appropriate offsite organizations, in the event of an emergency with offsite implications 2. formally document any arrangements or agreements with other organizations or personnel 3. ensure that agreed-upon resources, and the quantity of these resources required to respond to offsite conditions, are available when needed 4. cooperate with and assist offsite organizations with their response activities to address offsite impacts; provide expertise and resources (personnel, emergency response equipment, and material) in support of offsite authorities during an emergency; and define the quantity of available resources within their ER plan 5. promptly and regularly provide recommendations to offsite authorities when protective action is required and inform the CNSC 6. establish what data is required and at what frequency, and make provisions to have nuclear facility data, and any other pertinent information that is determined as relevant to the emergency response, regularly transmitted to offsite authorities and the CNSC Additional requirements for licensees of reactor facilities with a thermal capacity greater than 10 MW. These licensees shall:	would be implicit in the processes established in the plan that interface with off-site authorities. This includes off-site categorization of the emergency, provision off-site radiation monitoring data, provision of technical and liaison staff to the Provincial Emergency Operations Centre (PEOC), running BERP in parallel with the PEOC. Thus indirect compliance.	

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	1. incorporate the provincial or territorial emergency planning zone that is being used for plume exposure and ingestion pathways; the provincial or territorial plans shall be directly referenced 2. collaborate with the municipal or regional authorities to develop and maintain public evacuation time estimates based on current census data, and future population growth projections on a per-decade estimation until end of life of the facility 3. have, at all times, a designated onsite person with the authority and responsibility to categorize a nuclear emergency and to perform the following promptly and without consultation, upon categorization of the emergency: a. initiate an appropriate onsite response b. notify the appropriate offsite authorities c. provide sufficient information for an effective offsite response 4. provide the designated person with a suitable means of alerting onsite response personnel and notifying the offsite notification point 5. for NPPs, ensure there is a designated person onsite at all times with the authority for venting 6. for NPPs, ensure that offsite authorities and the CNSC are consulted before undertaking any venting activity, unless venting must be performed in an urgent manner to protect the structural integrity of		

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	containment; in such a case, every effort shall be made to inform the offsite authorities and the CNSC as early as possible 7. include, in each report to the CNSC and offsite authorities, estimates of when venting will be required 8. notify the province and the CNSC of all abnormal incidents as described in section 2.2.2 Guidance Guidance for all licensees Licensees should identify the jurisdictions, organizations or persons that could be formally involved in emergency preparedness and response activities pertaining to facility emergencies with offsite impacts, and then develop mutual aid and community agreements where appropriate. During an emergency it is critical to have an onsite person with the required authority to order emergency venting if required. However, this authority can be delegated if it is impractical to have a senior emergency officer onsite at all times. The ER plan should also define a clear and concise		

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	strategy for communications between onsite and offsite organizations. All communications, including event data and the decisions made throughout the emergency response, should be documented and recorded. While the licensee is required to provide recommendations to offsite authorities, it is at the discretion of the authorities to accept, reject or modify recommendations. The nuclear emergency response plans for offsite response organizations (those of provinces and municipalities as well as firefighters, emergency medical services personnel and police) should be included with licence application documents for licence renewal and new applications.		
2.2.5	All licensees shall: In accordance with ER plans and procedures: 1. develop and document emergency radiation protection measures that align with their radiation protection program Additional requirements for licensees of reactor facilities with a thermal capacity greater than 10 MW. These licensees shall: 2. have sufficient personal protective equipment	1.,2., 3. Section 4.2.3.6 of the BPNERP identifies the radiation protection measures for emergency responders. This includes assignment of dose limits. In addition, section 4.2.6 identifies the establishment of the Emergency Worker Centre to monitor and control the exposure of external emergency workers who may be required to enter areas affected by radiation. Per BP-PROG-08.01, Bruce Power uses an all hazards approach to the planning that effectively sustains a response without external assistance for a minimum of 72 hours.	C

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	(PPE) and provisions to respond to emergencies and protect the emergency responders for the first 72 hours without offsite assistance 3. maintain sufficient PPE and response equipment, calibrated and poised for immediate use in an emergency; the type and amount of PPE and defined emergency response equipment shall be based on criteria for design-basis accidents and beyond-design-basis accidents Guidance Additional guidance for licensees of reactor facilities with a thermal capacity greater than 10 MW Licensees should be able to manage the first 72 hours of an emergency response without offsite support, in case outside assistance is unavailable. Remotely located facilities (such as those on northern sites) may experience significant emergency response delays because of effects such as severe weather. In such cases, licensees should demonstrate how their ER plans have accounted for the possibility that offsite assistance may not be available for extended periods of time. Electronic dosimeters should be calibrated, poised and immediately available for designated emergency	DIV-EM-00002, Maintenance and Testing of Emergency Preparedness Faculties and equipment, referenced in BP-PLAN-00001 defines the process and frequencies, by which emergency facilities and equipment are periodically inspected, inventoried, operationally checked, and tested in order to support the BPNERP (Section 1.0). This includes a list of all location where emergency equipment and supplies are located, and includes off-site survey vehicles.	

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	work. Systems used for maintaining, reading and charging these dosimeters should be in working condition at all times. For battery-operated equipment, sufficient numbers of batteries should be available. Backup facilities and emergency response equipment needed to maintain equipment for electronic dosimeters, radiation instrumentation and laboratory services should be referenced within the ER plan. Emergency protective provisions may include, but are not limited to: • establishing or designating areas for the emergency assembly of site personnel • ensuring that assembly areas are located in areas that can be accessed safely during emergencies • ensuring that there are alternate safe access routes to radiation instrumentation and electronic dosimeters, in addition to assembly areas and PPE during emergencies • accounting for site personnel and all other persons on site (contractors, visitors, etc.); all onsite staff should be able to be accounted for within 30 minutes; accounting should be commensurate with the scale/categorization of the emergency • using dose records to assign specific emergency response tasks • ensuring offsite emergency responders have		

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	access to radiation protection assistance from onsite personnel • implementing special administrative measures, such as action levels to control radiation doses • conducting radiation surveys and radioactive contamination monitoring • monitoring and tracking of radiation doses • implementing back-out dose limits and protective actions when emergency action levels are exceeded through pre-set electronic personnel dosimeter alarms • providing search and rescue, decontamination and first aid services • providing dosimetry and any other emergency response equipment, instruments, materials, facilities and services necessary to ensure that onsite and offsite personnel are protected • ensuring appropriate radiological and hazardous substances protection and information are provided to all emergency responders, including those from external organizations providing onsite support • ensuring that PPE, electronic dosimeters and radiation survey meters / radiation instrumentation are appropriate for their intended use • interfacing with offsite responders (e.g., ambulance attendants and hospital staff) to ensure that pertinent hazardous material and radiological		

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	information is provided to medical staff • providing thyroid-blocking agents (potassium iodide pills) when applicable • briefing, tracking, and debriefing the dispatched teams on safety requirements, communication requirements, etc.; emergency response personnel's briefing should include personal safety requirements and a three-way communication strategy • continued verification of the habitability of all emergency response facilities, including monitoring for radiation fields and hazardous materials, where appropriate This document does not address shift turnover. Additional guidance on shift turnover can be found in CNSC Regulatory Document G-323, Ensuring the Presence of Sufficient Qualified Staff at Class I Nuclear Facilities – Minimum Staff Complement.		
2.2.6	All licensees shall In accordance with ER plans and procedures: 1. identify an onsite emergency response facility or designated area to be used as a response location 2. identify essential emergency response equipment,	Clause 2.2.6 is met by the BPNERP processes and its on-going review. However, while informal security arrangements are in place at the EMC and back-up EMCs, these need to be formalized in BP-PLAN-00001 and implementing procedures.	Gap

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	and describe how its operation and effectiveness during emergencies are assured; essential emergency response equipment includes equipment required to detect and assess hazards, and communicate response activities 3. identify and have emergency response equipment and materials that are operational and available in sufficient quantities for an extended multi-shift response; they shall also be readily accessible during emergency conditions Additional requirements for licensees of reactor facilities with a thermal capacity greater than 10 MW. These licensees shall: 4. have an emergency response facility (ERF) located onsite, but outside of the protected area; if this cannot be achieved, describe security arrangements to prevent nuisance actors from interfering with emergency response, and provisions for alternate means of communication in the event of a total communications blackout 5. have an emergency response facility located offsite and outside of the plume exposure planning zone 6. ensure that the emergency response facilities will ensure the health and safety of workers in the ERF		

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	and ensure the continuity of operations for all emergency situations that cannot be practically eliminated (if this cannot be achieved, then have backup facility with similar capability for each of the onsite and offsite such that the backup facility is unlikely to be effected by an event that would disable the primary; in addition, activation or transfer of operations to the backup facility must be done without disruption to the response operations) 7. provide a workspace with computer, internet access and telephone for a CNSC representative in each ERF; in addition, the CNSC shall be granted access to install an antenna for a satellite phone at each ERF 8. ensure all emergency response facilities have the capacity and capability of sustaining emergency response for a minimum of 72 hours without offsite support 9. ensure the design and layout of emergency response facilities are able to support the emergency response 10. ensure emergency response facilities have provisions in place to provide nuclear facility data 11. pre-arrange memoranda of understanding and/or other priority services agreements required to keep ERFs functional over prolonged periods, and ensure such agreements are documented and either referenced or attached to the ER plan 12. determine and implement methods for		

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	communicating with onsite personnel and offsite authorities, including the implementation of at least two levels of backup communications systems; licensee communication links must be compatible with the licensee, province or territory, and the CNSC Guidance Guidance for all licensees Licensees should describe the emergency response services, equipment, supplies and facilities that would be available during emergencies, including, but not limited to the following: • administration facilities • technical support centres • control facilities • personnel and public assembly areas • emergency operations coordination centre • centre to integrate onsite activities with offsite programs • first aid and/or medical facilities • laboratory services (fixed or mobile)		

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	• decontamination facility • backup power capable of sustaining emergency power to emergency response facilities for a minimum of 72 hours • reference materials, such as current and approved versions of charts, maps, plans, drawings, diagrams, specifications and procedures • essential safety equipment, PPE and other appropriate supplies, such as food and water for a minimum of 72 hours • administrative aids, such as status boards and reference materials • fixed or portable instruments or equipment, as required, to detect, measure, monitor, survey, analyze, record, process, treat, transport, warn, announce, communicate, or assess Additional guidance for licensees of reactor facilities with a thermal capacity greater than 10 MW The CNSC workspace should have appropriate resources (such as computers, information access, internet access and satellite phones) to enable CNSC representatives to perform their functions adequately. The preferred means of ensuring the protection of workers and the continuation of operation is to have		

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	hardened facilities within the primary zone that have: • radiological protection/shielding • adequate ventilation, • contamination control • the ability to withstand design-basis event hazards, such as wind, tornado, snow or ice		
2.2.7	All licensees shall: In accordance with the ER plans and procedures: 1. provide information about the emergency to offsite authorities during the emergency response and recovery phases 2. coordinate with offsite authorities when communicating emergency information to the public Guidance Guidance for all licensees In the emergency plan, licensees should describe the procedures to communicate information about the emergency to offsite authorities during emergencies. These procedures should ensure that emergency	1. BPNERP requires a number of information linkages with off-site authorities. The Emergency Management Centre is the primary emergency response interface with the PEOC. Bruce Powers Corporate Emergency Support Centre (CESC) is the primary interface with the CNSC Headquarters Emergency Operations Centre (Section 4.2.6). Official communication with the Municipal Emergency Operations Centre (MEOC) is through the Bruce Power provided liaison officer and the EMC. 2. Bruce Power has representatives on the Municipal EOC and the PEOC to liaise and coordinate with these organizations. Per the BPNERP, until the PEOC and its public communication function, the provincial Emergency Information Centre (EIC) is operational, Bruce power will continue informing the public and media about the emergency. When the EIC is operational, Bruce power will make staff available for comment and media briefings at the EIC request. During recovery phase, communications with the public on the event, causes, impact will	C

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	information is sent routinely – and as conditions change (either positively or negatively) – to offsite authorities so the information can be disseminated to the public. The information communicated to offsite authorities should include possible radiological and non-radiological hazard(s), including their short-term effects as well as their potential long-term effects on the public, for all emergency scenarios. In the emergency plan, licensees should describe the protocols to ensure coordinated public communications during an emergency. For nuclear power plants, provisions should include consideration of communications strategies and describe the roles and responsibilities of organizations that are responsible for communicating key information to the public	continue.	
2.2.8	All licensees shall: In accordance with ER plans and procedures: 1. describe the process to transition from emergency response to recovery after the termination of an emergency, including the requirements to establish a recovery organization and to develop a recovery plan 2. identify, in the recovery plan, the positions/titles,	1. As invoked by BP-PROC-00317, The Recovery Director is appointed by the Executive team to oversee a team in recovery operations. A number of additional positions as identified in BP-PROC-00317 support this role. 2. The BPNERP does not specify the process for developing recovery plans. However, per BP-PROG-08.01, recovery plans are identified through BP-PROC-00317, Crisis Management, and the use of business continuity procedures, with oversight	Gap

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	authorities and responsibilities of the individuals who will fill key positions in the recovery organization; this organization shall also include technical personnel with responsibilities to develop, evaluate and direct recovery and reentry operations Guidance Guidance for all licensees A conceptual and strategic recovery plan should be prepared in advance. This can act as the basis for developing the recovery plan after the event has occurred and the emergency phase is complete. The recovery plan should: • identify and describe the resources (personnel, facilities and emergency response equipment) that are to be available for recovery purposes • describe how personnel will be protected when assessing or implementing the recovery program (e.g., personnel protection measures for entry into hazardous areas) • provide for post-accident assessments of the	provided by the Crisis Management Team. In accordance with this procedure, each business group is responsible for developing and maintaining their own recovery procedures. While the basic structure for recovery plans is in place, it is considered that the intent of REGDOC-2.10.1 is not fully met. Per NK29-CORR-00531-12566, a transition plan for full compliance with REGDOC-2.10.1 by August 31, 2018 is in place. A test of the concept of recovery planning is part of Exercise Huron Resolve in the fall of 2016. Lessons learned from this exercise will be incorporated into revised recovery plan governance. This is considered to be a gap.	

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	causes, details, impacts and/or consequences of the events • ensure all recovery efforts operate in accordance with the licensee's operating licence requirements Once the emergency phase of an emergency response has ended, workers undertaking recovery operations (such as repairs to plant and buildings, waste disposal or decontamination of the site and surrounding area) are subject to the occupational dose limits listed in the CNSC's Radiation Protection Regulations.		
2.2.9	All licensees shall: 1. validate ER plans and procedures to demonstrate that systems as designed (equipment, procedures and personnel elements) meet performance requirements and support safe operation 2. validate any changes to ER plans or procedures before implementing them, to ensure continued effectiveness 3. unless otherwise specified in the licence conditions handbook, notify the CNSC of changes to ER plans and procedures, and submit the results of the validation to the CNSC as per the terms and conditions of the CNSC licence	1. ER plans are validated through drills and exercises that are conducted regularly, exercising parts or all of the BPNERP, for different scenarios so as to continually improve processes. 2.,3. DIV-EM-00003, Emergency Preparedness Requirements Management to review whether changes to emergency response procedures, ERO or facilities will require a revision to the NERP, and hence CNSC approval, and if so to ensure the rationale for the change is adequate. However, this document does not strictly address "validation" of the change. Given the context of and means of validation for bullet 1, this is considered indirect compliance.	IC

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	Guidance Guidance for all licensees For the purpose of this section, “change” means an action that results in modification to, addition to, or removal from a licensee’s ER plan. All changes should be validated to demonstrate that performance requirements are met and to determine if there has been a reduction in effectiveness (i.e., decreased capability to respond to an emergency). A licensee may make changes to its ER plan(s) and procedures without CNSC approval, but only if it performs and retains an analysis that demonstrates that the changes have not reduced the ER plan’s effectiveness. This analysis must also demonstrate that plans continue to meet operating licence requirements as well as regulatory requirements. A change to a licensee’s ER plan and procedures that reduces the effectiveness of the plan is not to be implemented without prior acceptance by the CNSC. A licensee desiring to make such a change should submit an application for change approval to the CNSC; the request should include the revised ER plan and demonstration of validation. The CNSC will have		

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	30 days to review a change request, after which it will inform the licensee if the change has been accepted. The CNSC is unlikely to permit changes that would decrease an ER plan's effectiveness; however, under special circumstances (e.g., construction or temporary facility modifications), such changes may be approved with specific conditions. Under no circumstances would the CNSC allow a licensee to implement changes that would compromise safety or lead to unreasonable risk. Minor or administrative modifications to programs or procedures can be reported to the CNSC through established channels such as the Quarterly Operations Report or through formal correspondence.		
2.3.1	All licensees shall: In accordance with training and qualification: 1. collaborate with responding offsite agencies to educate them on radiation protection Additional requirements for licensees of reactor facilities with a thermal capacity greater than 10 MW. These licensees shall: 2. develop and submit emergency drill and exercise	1. Per the BPNERP, Procedures are in place to allow for the access and the radiation protection requirements of off-site support staff responding to the site. Bruce Power supplies call-in staff to fulfill some technical positions in the PEOC Technical Group and an official liaison position in the PEOC Operations Group. The Liaison Officer with the Municipal Emergency Operations Centre (MEOC) will also provide radiation level interpretation and technical background information for the municipal staff. 2. Per BP-PROC-00010, A comprehensive list of drill and exercise objectives is defined and a schedule for conducting drills and exercises is established so that all of the objectives are tested within a set period	C

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	schedules annually to the CNSC 3. train and qualify all emergency response organizations (EROs) in accordance with the positions to which they have been assigned; educational materials are required to be available for any person who would be responding to the emergency on behalf of an offsite authority, not just the first responders 4. establish requirements for frequency of re-qualification training for all ERO positions Guidance Guidance for all licensees Licensees should provide necessary training to individuals and/or organizational units to assure and demonstrate they are qualified and able to completely fulfill their assigned emergency response roles. The training is intended for any person who would be responding to the emergency on behalf of an offsite authority and is not solely limited to first responders. ERO training may consist of both formal and informal instruction (including workplace and classroom instruction). Licensees can also develop and use online training materials. Emergency drills are an additional option. Typical attributes of an emergency	of time. The schedule is reviewed at least quarterly. The CNSC is included on the distribution list. 3. Per BPNERP, section 4.1.2.3, TQD-00005, ERO Training and Qualification, describes the program that is used to qualify and train personnel appointed to the ERO. This program was developed using the Systematic Approach to Training (SAT). 4. The Continuing Training frequency for ERO positions is 18 months as specified in TQD-00005, Emergency Response Organization Training and Qualification Description.	

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	drill include: • limited scope • limited number of personnel • specific equipment • timely feedback • realistic environment An emergency drill typically involves testing a procedural or physical component of the emergency response program. An emergency drill may be conducted as an initial or periodic test, as a supervised training session or as an evaluation of a remedial event. For example, after steps are taken to correct a weakness identified by an emergency exercise, a drill may be held to further evaluate the effectiveness of the remedial measures. Licensees should describe the following: • initial and continuing training programs for EROs • ERO staff qualifications • ERO positions for which incumbents will be required to undertake periodic or on-going training • training requirements for contractors and offsite organizations (e.g., firefighters, police personnel, ambulance drivers, hospital staff) that		

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	support or participate in onsite activities – insofar as these requirements relate to training that is outside their typical professional duties, but that is required for responding to onsite emergencies; such training could address subjects like access requirements or radiation protection • schedules, procedures and assessment criteria for the conduct of emergency drills and exercises • positions responsible for managing, planning, controlling and evaluating drills Personnel assigned to emergency response roles should demonstrate and maintain their capability to perform assigned tasks at all times. Drills should include the use of all procedures, PPE, response equipment and facilities that could be required during an actual emergency. Requirements and guidance for training systems can be found in REGDOC-2.2.2, Personnel Training.		
2.3.2	All licensees shall: Identify and implement requirements and provisions to assure that the necessary emergency response facilities, equipment, and materials are maintained and in working condition at all times. However, facilities and equipment may be taken out of service for required maintenance if alternate provisions are put in	DIV-EM-00002, Maintenance and Testing of Emergency Preparedness Faculties and equipment, referenced in BP-PLAN-00001 defines the process and frequencies, by which emergency facilities and equipment are periodically inspected, inventoried, operationally checked, and tested in order to support the BPNERP. This includes a list of all location where	C

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	place during these periods. Guidance Guidance for all licensees Emergency response facilities, equipment and materials must be in a state of readiness at all times. Accordingly, licensees should implement provisions to ensure that such equipment, facilities and materials are always in working condition. These provisions are to include regular inspection, calibration, testing, and maintenance, or replacement as required, within formal systems of quality control and inventory control and accounting. This criterion includes all required PPE.	emergency equipment and supplies are located, and includes off-site survey vehicles.	
2.3.3	All licensees shall: 1. test the implementation of their emergency measures Additional requirements for licensees of reactor facilities with a thermal capacity greater than 10 MW. These licensees shall:	1. Section 4.4. of the BPNERP identifies the scope and frequency of drills and exercises, including the planning and design process for scenarios, the process for conducting a drill or exercise and the evaluation process. BP-PROC-00010, Emergency Preparedness Drills and Exercises provide the detailed process. Additional requirements 1. Per BPNERP.	IC

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	1. perform exercises to test the effectiveness of their EP program 2. ensure emergency exercises are based on their planning basis; for multi-unit nuclear reactor facilities, licensees must ensure that multiple-unit emergency exercises are part of their exercise repertoire 3. establish specific objectives for each emergency exercise; the type and number of objectives will depend on the size of the facility and the scope of the exercise 4. design exercise objectives to sufficiently challenge their capability and capacity to respond to emergencies 5. include provisions in emergency exercise objectives for: a. assessment b. protection of facility personnel c. protection of the public and the environment d. termination of an emergency e. adequacy and conduct of exercises 6. test all requirements listed in this document over a five-year period, with a full-scale integrated emergency testing exercise at least once every three years involving, at a minimum, regional and provincial offsite authorities 7. submit emergency exercise objectives, team organization and scenario development framework to	2. The planning basis for the BPNERP covers Design Basis Accidents (DBAs), and a multi-unit sustained loss of ac power. Its structure can also cater to the response to BDBAs addressed through SAMGs. Emergency exercises are based on this planning basis. The Huron Challenge IV represented a station loss of Class IV and Class III power exercise. Hence this is assessed as indirect compliance. 3. Per BPNERP. Per BP-PROC-00010, All Drill and Exercise Performance Objectives shall be assessed at each site over a three-year period. A list of performance objectives is provided in Appendix B of BP-PROC-00010. 4. Per BPNERP. 5. Per BP-PROC-00010, termination of an emergency is built into exercise design, and frequency is to be tested once per year. 6. A matrix of performance objectives and their observables and test frequencies is included in Appendix B of BP-PROC-00010. BPNERP and BP-PROC-00010 defines the test frequency for each component or test group. Except for hospital radiological contaminated casualty and local off-site centres, which are per mutual agreement with local jurisdiction, the frequency is every three years or earlier. A full-scale corporate exercise (Shift ERO, EMC, CESC) is performed yearly. (Performance objectives in BP-PROC-00010 are from AECB INFO-0667, Recommended Criteria for Evaluation of On-	

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	the CNSC at least 20 business days before conducting full-scale emergency exercises (in case of operational requirements and factors beyond licensee control, changes can be made up to the day of the exercise) 8. execute exercises that will meet all stated objectives, demonstrate thorough planning, and identify weaknesses and deficiencies so they can be prioritized and corrected; and provide an overall accurate indication of their emergency response capabilities 9. demonstrate sound organizational and professional execution in the conduct of the exercises by: a. keeping exercise scenarios unknown to the emergency responders before exercises are conducted b. providing timely and realistic data, messages and materials c. having exercise participants demonstrate realistic and professional behavior for simulated actions 10. ensure persons perform their required tasks during exercises as though actual emergency conditions were present 11. staff and train exercise controllers and evaluators to control and evaluate exercises, and provide them with exercise materials that include: a. instructions about how to conduct exercises	Site Nuclear Power Plant Exercises, 1997, which has not been updated. 7. The requirement specified in BP-PROC-00010 is for final package to be submitted top CNSC at T= -14 (calendar) days. The yearly schedule is negotiated with external groups per BP-PROC-00010 and the integrated drill schedule is distributed to external groups, including the CNSC. 8. Per BPNERP section 4.4.5, a schedule to address the corrective actions is developed and tracked in the corrective action tracking system. Per Section 4.5.2 of BP-PROC-00010, an Exercise Development Team is assembled to assist in developing scenarios, ensuring stated objectives are met, and consider external stakeholder input. 9. BP-PROC-00010 ensures scenarios are validated or walked through by operations technical staff and emphasizes scenario for the exercise is considered confidential information and is not to be divulged to any players. Per Table 2 of BP-PROC-00010, ground rules are sent to all players at T=-7 days. 10. BP-PROC-00010 Appendix C Section 5.2 element 10: "Players are expected to respond as if the emergency event were real. Controllers and evaluators shall instruct players on the appropriate degree of simulation as necessary" 11. Pre-drill and exercise sessions are held with evaluators and controllers per BP-PROC-00010.	

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	b. exercise evaluation criteria 12. provide direction pertaining to existing requirements for safety and security measures adhere to applicable regulations and licence conditions during exercises, ensuring all participants are aware of the actions and interventions that are not permitted while exercises are in progress 13. provide feedback after exercises to improve their overall ability to respond effectively to emergencies 14. prepare self-assessment reports regarding the execution of full-scale emergency exercises; such reports must be submitted to the CNSC 40 days after exercises have been conducted (in exigent circumstances, reports could be delayed to no later than 90 days following the conclusion of exercises) Guidance Additional guidance for licensees of reactor facilities with a thermal capacity greater than 10 MW Emergency exercises test the adequacy of EP programs and the implementation of emergency measures. This includes an evaluation of the adequacy of the procedures and training of the ERO to respond to an emergency.	12. As part of Pre-drill and exercise sessions are held with evaluators and controllers, ground rules and clear instructions with respect to plant and personnel safety are provided. 13. Per BPNERP, and BP-PROC-00010 requirements. 14. Per BPNERP, and BP-PROC-00010 requirements, exercise reports are issued within 90 days.	

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	Emergency exercises simulate emergency events and conditions over a minimum of several hours, in order to test the integrated performance of the EP program. Emergency exercises simultaneously measure and demonstrate: the preparedness and competence of participants in the specific emergency response roles, the quality of the associated procedures, and the effectiveness of the administrative framework. Exercises designed with a high degree of fidelity ensure that the performance observed could be reasonably expected during an actual event. Deficiencies that are identified during emergency exercises should be rectified as soon as possible, to provide assurance that the ER plan and procedures can and will be implemented successfully in the event of an emergency. Typical attributes of an emergency exercise include: • mobilization of emergency equipment and resources in a realistic environment over an extended period of time • demonstration of inter-agency and other government department cooperation • testing of communication systems and/or public information systems • testing of emergency response facilities and equipment readiness • conduct of the exercise with the minimum complement numbers of staff, in order to demonstrate		

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	adequacy of the response • criteria to terminate the exercise that are established ahead of time, in order to ensure that all of the required actions are completed • success criteria that are established during the planning phase, and a corresponding evaluation of performance during the exercise A full-scale integrated exercise tests the capacity of onsite and offsite agencies to respond to an emergency that results in a release of nuclear substances from the affected unit(s). Full-scale emergency exercises involve, at minimum, several onsite and provincial and regional offsite stakeholders. Larger full-scale exercises can include federal and – where appropriate – international authorities and agencies. Emergency exercises do not always need to be full-scale. For example, tabletop emergency exercises, such as those for notification and communications, may be sufficient to stimulate discussion of various issues regarding a hypothetical emergency. Emergency exercises should not be used as part of a participant's training development. Participation in an exercise is not meant to evaluate an individual's competency, but rather is intended to assess the adequacy of an EP program and its implementation. Coaching and training should not be provided to		

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	participants in exercises by controllers or evaluators. Exercises should be conducted in accordance with the minimum requirements of the ER plan. Self-assessment reports should contain the following information: • success and failures of exercise drills • lessons learned • areas for improvement • corrective action plans		
2.3.4	All licensees shall: Incorporate information on public emergency preparedness into their public information program (established as per RD/GD-99.3, Public Information and Disclosure) to ensure information on emergency preparedness and response is communicated to surrounding communities and stakeholders. Additional requirements for licensees of reactor facilities with a thermal capacity greater than 10 MW and with designated offsite emergency planning zones. These licensees shall provide the necessary	BPNERP section 4.1.2.4 outlines public education requirements for both emergency preparedness and response. 1-8, Pre-distribution of Iodine Thyroid-Blocking (ITB) agents to the public and agencies is a LCH condition and was required to be completed by December 31, 2015.	C

Article No.	Clause Requirement	Assessment	Compliance Category
	resources and support to provincial and municipal authorities in implementing the provincial and municipal plans to do the following, or shall do the following: 1. ensure that a sufficient quantity of iodine thyroid-blocking (ITB) agents is pre-distributed, to all residences, businesses and institutions within the designated plume exposure planning zone, together with instructions on their proper administration 2. ensure that a sufficient quantity of ITB agent is pre-stocked and ready for prompt distribution within the designated ingestion control planning zone; this inventory of ITB agents shall be located so that it can be efficiently obtained by, or distributed to, members of the public when required 3. ensure that ITB agents can be obtained by residents of the designated ingestion control planning zone at any time 4. ensure that particular consideration is given to sensitive populations such as children and pregnant women within the designated ingestion control planning zone 5. ensure that the pre-distributed and pre-stocked ITB agents are maintained within expiry date 6. ensure that the pre-distribution plans are supported by a robust, ongoing, and cyclical public education program 7. ensure that all residences, businesses and institutions within the designated plume exposure		

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	planning zone are provided with public emergency preparedness information detailing how they should prepare for a nuclear emergency and what they should do or expect during a nuclear emergency; this information will reinforce the public education program designed to support the pre-distribution of ITB agents 8. ensure that this public emergency preparedness information is readily available to the general public, including online Guidance Guidance for all licensees Licensees may, where possible, leverage existing communication channels (such as those used by local municipalities or those identified in their public information program as per RD/GD-99.3, Public Information and Disclosure). Licensees should periodically assess the adequacy of public emergency preparedness information. Additional guidance for licensees of reactor facilities		

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	with a thermal capacity greater than 10 MW For reactor facilities with a thermal capacity greater than 10 MW and with designated offsite emergency planning zones: The term ITB agent is used generically and includes potassium iodide (KI) tablets. The pre-distribution of ITB agents should be undertaken by representatives of the health and/or emergency management authorities of the province or region/municipality, with support from the licensee. The pre-distribution of ITB agents should be done in a carefully planned and coordinated manner, to ensure that the public receives the appropriate information and education related to the benefits, risks and usage instructions of ITB agents. Pre-stocked ITB agents for the designated ingestion control planning zone should be located to facilitate prompt and efficient distribution during an emergency. Recognizable locations with credible persons within the community (such as fire stations, police stations and pharmacies) should be considered in the selection of pre-stocking locations.		

Article No.	Clause Requirement	Assessment	Compliance Category
	Following the completion of pre-distribution activities, periodic reviews with the local populations to assess the adequacy of pre-distribution programs should be performed. The term “designated plume exposure planning zone” is sometimes referred to as “primary zone”, “urgent protective action zone” or “emergency planning zone”. The size of the plume exposure planning zone is determined by the appropriate offsite authorities based on information in the planning basis and is typically sized in the range of 8 to 16 km. The term “designated ingestion control planning zone” is sometimes referred to as “secondary zone”, “extended planning distance” or “ingestion planning zone”. Appropriate offsite authorities determine the size of the ingestion control planning zone (typically in the range of 50 to 80 km) based on information in the planning basis. To ensure the public have easy access to the required emergency preparedness information, licensees should collaborate with municipalities to provide residents with useful information on how they should prepare, what they should expect and how they should respond to an emergency at the nuclear facility.		

Article No.	Clause Requirement	Assessment	Compliance Category
	An emergency preparedness information product should be distributed in hard copy annually to every residence, business and institution within the plume exposure planning zone, and posted on a variety of websites, including those of the licensees, municipalities and provincial EMOs. This should include information on: • how they will be alerted • how they will be notified or informed on what to do • sheltering-in-place instructions • evacuation orders • how/when to take ITB agents, and where to get them if not pre-distributed • contact details for where to obtain additional information, such as websites and social media sites Licensees may, where possible, leverage existing communication channels (such as those used by local municipalities or those identified in the public information program). In discussion with local authorities, licensees should consider providing public preparedness information with ITB packages when distributing to local		

Article No.	Clause Requirement	Assessment	Compliance Category
	populations.		
2.4	All licensees shall: Include, at a minimum, the following elements in their management systems: 1. a written policy statement issued by licensee senior management, committing all units of the organization to the system and its effective implementation 2. a program owner identified with the authority to ensure that resources are given to all aspects of the EP program 3. procedures describing the planned and systematic actions necessary to provide adequate confidence that all specified requirements are satisfied 4. procedures that specify who (position or unit) is to review and update the program on an ongoing basis, and how this is to be done 5. review and update EP program and associated documentation (e.g., response plan, training material, procedures, etc.) at defined intervals to take into account relevant factors, such as operating experience, changing needs or circumstances, and lessons learned from real events Guidance	1. Appendix A of BP-MSM-1, Management System Manual, provides the following policy in regard to emergency preparedness: "Bruce Power shall ensure adequate planning and preparation is in place to deal with any emergency situations that could endanger the safety of site staff, impact on the protection of the environment, and/or impact on the safety of members of the public. Bruce Power shall manage emergencies using an "all hazards" approach, encompassing mitigation, preparedness, response and recovery." 2. BP-PROG-08.01, Emergency Management Process, is approved by the Chief Legal Officer and Vice President Emergency, Management Division. The Department Manager, Emergency & Protective Services Programs and Integration is the accountable program owner as identified in BP-MSM-1 SHT0001. 3. At a high level, BP-MSM-1 identified the following high level components to managing the business: " Strategic Direction. " Plan Policy, Program and Process Controls. " Do Process Management. " Check Monitoring for Results.	C

Article No.	Clause Requirement	Assessment	Compliance Category
	Guidance for all licensees The EP program should be managed as part of a facility's overall management system. A management system is generally defined as a set of interrelated or interacting elements that establish policies and objectives, and that enables those objectives to be achieved safely, efficiently and effectively. The management system brings together the processes needed to satisfy EP program requirements in a planned and integrated manner. The management system's requirements primarily aim to ensure that safety is not compromised, by considering the implications of all actions with regard to safety as a whole. Safety should be the paramount consideration, guiding decisions and actions, in the establishment of a management system. As stated in their licences and licence conditions handbooks, licensees should: • manage their EP programs in accordance with management system requirements • detect and report deficiencies, and ensure all corrective actions are tracked and implemented as per management system requirements	" Act Continuous Learning " Leadership and Organizational Accountability BP-PROG-08.01 identifies the planned and systematic actions to ensure all specified requirements are satisfied. These are supported by various implementing processes and procedures. 4,5, The Department Manager, Emergency & Protective Services Programs and Integration is the accountable program owner as identified in BP-MSM-1 SHT0001. Per BP-PROG-08.01 Hazard Identification, risk assessment, impact analysis to determine planning requirements are all conducted at a minimum of every five years or when deemed necessary by the Emergency Management Oversight Committee or CNSC. Program performance assessment is performed per SEC-EPP-00007, Emergency Management Programs Assessment. BP-PROG-01.06, Operating Experience Program, provides methods for Focused Area Self-Assessments and BP-PROG-15.01 provides methods used for program Audits. B-ERP procedures are reviewed every three tears. In addition BP-MSM-1 identifies the VP Regulatory Affairs and nuclear Oversight with providing programmatic governance and oversight of a process that ensures periodic management review of the of the management system. The review will monitor and confirm its effectiveness, adherence to requirements and assess the need for changes to the management system, its principles and scope.	

B.2. CNSC REGDOC-2.3.2, Accident Management

In support of the review tasks listed in Section 5, a detailed assessment of REGDOC-2.3.2 (Version 2) has been performed in Table B2.

Table B2: CNSC REGDOC-2.3.2, Accident Management

Article No.	Clause Requirement	Assessment	Compliance Category
3.1	In accordance with the NSCA and associated regulations, the overarching nuclear safety objective is to protect individuals, society, and the environment from harm by establishing and maintaining effective defences against radiological hazards and hazardous substances. When an accident occurs in a nuclear reactor facility, the above objective is achieved by fulfilling the following fundamental safety functions: o control of reactivity o removal of heat from the fuel o confinement of radioactive material o shielding against radiation o control of operational discharges and hazards substances, as well as limitation of accidental release o monitoring of safety-critical parameters to guide operator actions The specific goals of accident management are to: o terminate the progression of the accident as	This clause details the high level requirements of an accident management program. The suite of design features, safety analyses, operating manual and AIMs, as well as Severe Accident Management Guidance (SAMG) and Emergency Mitigating Equipment (EME) guidance and equipment, collectively meet these requirements in a general fashion	C

Article No.	Clause Requirement	Assessment	Compliance Category
	early as possible o prevent an accident from leading to severe consequences o maintain the integrity of fission product barriers including containment and spent fuel storage o minimize the release of radioactive materials into the environment o achieve a long-term safe stable state of the reactor core or spent fuel storage To fulfill these high-level requirements, the licensee shall meet all the requirements specified in this section and consider the guidance given in sections 4, 5, 6 and 7.		
3.2	1. identify and implement reactor-specific accident management measures to ensure that adequate capabilities are maintained to cope with scenarios ranging from AOOs to severe accidents 2. address, to the extent practicable, the initiating events that have the potential to cause extensive infrastructure damage such that offsite resources are not readily available 3. ensure that accident management measures cover all modes of reactor operation including the shutdown state; events that could cause damage to the fuel in a reactor core, in transport to storage, or stored in a spent fuel pool shall be considered	1, Site specific Operating Manuals (OMs), Abnormal Incidents Manuals (AIMs), SAMG Emergency Response Procedures, and EMEG and associated provisions collectively represent reactor specific Accident management measures. This is considered indirect compliance. 2,3, The Bruce Power Emergency Management Program is predicated on an all-hazards approach that does not rely on external resources for 72 hours. (BP-PROC-08.01). Specific OMs and AIMs cover shutdown states and accidents involving the spent fuel bay.	IC

Article No.	Clause Requirement	Assessment	Compliance Category
	4. identify and document challenges to safety functions and physical barriers and perform safety analysis 5. identify and confirm reactor site capabilities to cope with the challenges to safety functions in performing accident management actions 6. conduct periodic reviews, drills and integrated exercises to confirm or improve the effectiveness of the established accident management measures 7. ensure that the accident management processes and activities interface with the emergency preparedness 8. make accident management provisions, including: a. developing criteria for determining what procedures to use b. demonstrating the capability to take actions to protect and inform personnel at the scene c. identifying the roles and responsibilities of the personnel responsible for accident management d. identifying and evaluating reactor systems and features suitable for use during accident management	4,5, An on-going program of hazard identification, safety analysis and Probabilistic Risk Assessment (PRA) identifies and analyzes challenges to safety functions and updates relevant documentation. 6. Also part of N286 compliance. AIMs are exercised as part of refresher training. For the nuclear emergency plan, objectives to be tested and minimum frequency of drills and exercise that support the program are specified in the BPNERP (section 4.4). 7. Conditions for definition of a station emergency and thus activation of the ERO are defined in the Bruce Power Nuclear Emergency Response Plan (BP-PLAN-00001) section 4.2.2.1. In addition, various AIMs (e.g., (Loss of Coolant Accident (LOCA), steam line break, Main Control Room (MCR) uninhabitable), also require the declaration of a station emergency. 8. Criteria for which procedures to use are specified in various documentation. For general response to transients, DIV-OPB-00005, Crew Response to Upsets, describes the roles and responsibilities that are required to be carried out when a duty shift crew responds to a transient condition on one or more Units. In addition the BPNERP represents the overview document, supported by various implementing documents, for response to a station	

Article No.	Clause Requirement	Assessment	Compliance Category
		emergency. General SAMG strategies are provided by the Diagnostic Flow Chart and the Severe Challenge Status Tree, again supported by various implementing document, including required training.	
3.3	Licensees shall: 1. provide capabilities to preserve the physical barriers for release of radioactivity and to ensure that means are available to: a. control challenges posed by DBAs within appropriate limits b. mitigate consequences of BDBAs c. reduce radiation risks from releases of radioactive materials by carrying out accident management actions 2. address the information needs for accident management, by providing instrumentation that is capable of: a. diagnosing that an accident, including a severe accident, is occurring or has occurred b. obtaining information, as necessary, on key parameters (which may include neutron flux, temperatures, pressures, flows, combustible gas concentrations, and radiation levels) to assess accident conditions and progression	1. Capabilities for challenges posed by Design Basis Accidents (DBAs) (and some Beyond Design Basis Accidents (BDBAs)) are assessed and confirmed within appropriate limits through Safety Analysis documented in the Safety Report, and PRA analysis. Emergency Operating Procedure (EOP), SAMG, and Emergency Plan (EP) actions reduce risks from possible releases of radioactivity. EME guide (NK29-EME-03504.1.) addresses some BDBA (loss of Class IV, Class III, and EPS) which includes make-up to reactor units and Irradiated Fuel Bays (IFBs). All generic CNSC Fukushima Action Items have been satisfactorily completed as confirmed by the CNSC in NK29-CORR-00531-12829. However, station specific action items opened to track implementation of items committed remain in progress. Such items include installation of permanent moderator and PHTS makeup connection points and installation of shield tank overpressure protection modifications. All items are on track to meet the committed completion dates. This is considered an acceptable deviation. 2., 3., For DBAs, the Equipment Qualification (EQ) program Equipment Qualification Assessments (EQAs) confirm instrumentation survivability to assess the need for and effectiveness of accident	AD

Article No.	Clause Requirement	Assessment	Compliance Category
	c. addressing continuously the state of essential safety functions, including reactor core monitoring, reactivity control, fuel cooling, hydrogen control, and containment d. confirming the effectiveness of the accident management actions 3. demonstrate with reasonable assurance that the equipment and instruments used in severe accident management will survive and perform their intended functions in the ensuing harsh conditions	management actions. These are also credited for many BDBAs, including severe accidents. Per NK29-CORR-00531-12635, Fukushima Action Item 1.8.1 on Instrumentation and Equipment Survivability was closed based on the completion of the COG generic methodology for performing survivability assessments in CANDU nuclear power plants. The Bruce specific Instrument and Equipment survivability assessment was completed and the summary report was provided to the CNSC. The assessment demonstrated that the vast majority of the BDBA and SAMG High Value Instrumentation and Equipment that can be used to maintain fuel cooling, containment integrity and control fission product release have a Reasonable Chance of Survivability (RCOS). No cliff-edge effects were identified and it was concluded that the SAMG framework is fundamentally robust and can be executed. However, per NK29-CORR-00531-12635, moderator level transmitters and associated components require field work to make them environmentally qualified for a steam line break environment. This is considered an acceptable deviation as it is has met the Fukushima Action Item (FAI) requirements to provide a schedule.	
3.4	Licensees shall: 1. develop, verify and validate accident management procedures and guidelines, including EOPs, emergency mitigating equipment guidelines (EMEGs) and SAMGs as applicable 2. account for factors specific to the reactor	1. AIMs are validated by at least two methods during initial issue, and at least one method following significant revisions, per BP-PROC-00250, Abnormal incident Manual (AIM) Management. Validation of SAMG is performed during training and exercises. Large scale exercises, as well as more specific exercises and drills validate the nuclear emergency	AD

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	design in the development of SAMGs for severe accidents 3. consider that information available to the operating staff or emergency groups may be incomplete and characterized by significant uncertainties 4. include the following in SAMGs: a. the parameters and their thresholds that define the transition from EOPs to SAMGs b. key parameters to diagnose the state of various reactor and reactor systems throughout the progression of the accident c. actions to be taken to counter the damage mechanisms that would challenge the integrity of the containment, irrespective of predicted frequencies of occurrence for those damage mechanisms d. indicators that can be used to judge the success of the implemented actions e. the communication protocol to be followed during implementation of accident management f. guidance on dealing with multi-unit damage, uncovered fuel in spent fuel pools, releases of radioactive materials and hydrogen into buildings adjacent to the containment 5. ensure the EOPs and SAMGs consider long time periods to initiate and complete required actions, taking into account the human and organizational performance and the possibility of prolonged time	plan. 2. Generic SAMG are adapted to the reactor design. Updates to account for multi-unit events, hydrogen management, in-vessel retention, and IFB are complete (e.g., NK29-CORR-00531-12635). 3. Instrumentation and equipment survivability modifications for moderator level transmitter and associated components in a steam line break environment are required (NK29-CORR-00531-12635). This is considered an acceptable deviation. See clause 3.3 assessment. 4. EOPs include Critical Safety Parameter (CSP) monitoring and initiation of SACRG1 if not restored (i.e., entry into SAMG). SAMG include monitoring of parameters in DFCs and SCSTs, specifying need for additional strategies when “setpoints” are exceeded. Communications protocols are defined in the BPNERP when a station emergency is declared, and specific communications protocol for SAMG actions are identified in SACRG-1 and SACRG-2. As per 2, guidance for multi-unit damage, uncovery of spent fuel bay, and hydrogen management are completed. 5. EOPs are subjected to validation which provides assurance they can be executed as written. SAMGs are executed in parallel with EP exercises. 6. Per 4. 7. EOPs include long term monitoring activities which facilitate transition into accident recovery activities. SAMG SAEG-1 addresses monitoring of long term	

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	required to restore power due to multi-unit damage or large-scale external disturbances 6. include steps into guidelines for events where supplementary equipment (also called emergency mitigating equipment (EME)) and where external supports are required to mitigate the accident consequences 7. provide for transition from the accident management activities to accident recovery1 1 Accident management (e.g., post-accident monitoring of fuel and containment) plays an important role in transition to recovery. REGDOC-2.10.1, Nuclear Emergency Preparedness and Response, provides information concerning recovery actions taken to restore the organizations involved in and the communities affected by the nuclear emergency.	concerns with the implemented SAGs/SCGs. SAEG-2 provides information for the TSG that is used to support plant recovery actions after the conditions for termination of SAMG are met.	
3.5	Licensees shall: 1. ensure that personnel involved in managing an accident have the information, procedures, and human and materiel resources to carry out accident management actions 2. provide training to the personnel who are required to respond to accidents to a level commensurate with their respective roles in accident management 3. ensure habitability of facilities required to support human performance during the	1. Update of SAMG (e.g., per NK29-CORR-00531-12635), is considered complete 2. Training is Systematic Approach to Training (SAT) based, including for ERO staff, per TQD-00005 3. Habitability assessments for BDBA are complete (e.g., NK29-CORR-00531-12635).	C

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	implementation of accident management measures or provide alternate habitable facilities		
4.1	A structured top-down approach (as illustrated in appendix A) should be considered. At the top level, the objectives of accident management should be defined according to the level of defence and associated goals that are given in section 3. Challenges to safety functions and physical barriers, together with the associated damage mechanisms and conditions, should be identified. This is referred to as identification of challenges. For each of the identified challenges, suitable measures or provisions should be derived, described, and referenced or documented in procedures or guidelines, and used for training the personnel responsible for executing the measures for managing such an accident, should it occur. The staff responsible for developing accident management strategies should have training and experience regarding accident management in a nuclear facility.	Bruce Power's various programs and measures collectively meet the intent of structured top-down approach. However, there is no overarching "Accident management Program." Given the historical basis of the current programs, this is considered an acceptable deviation.	AD
4.2	For setting out integrated accident management, the following steps should be taken: o identification of challenges to the reactor safety functions o identification of reactor capabilities	(All of 4.2 clauses) Bruce Power various programs and measures, while historically developed, meet the intent of the identified steps for an IAMP. Safety Report analyses, PRA, and hazard analyses identify events and sequences that could be caused by credible failures or malfunctions of SSCs, human errors, common-cause internal and external hazards, and combinations thereof, and are thus considered in	IC

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	o development of strategies and measures to cope with the identified challenges o performance of supporting analyses to evaluate and confirm the adequacy of the strategies and measures developed o development of procedures and guidelines o consideration of other elements such as equipment and instrumentation provisions, organizational responsibilities, and communication interfaces While following the above major steps for establishing integrated accident management, the licensee should also consider the following important elements as described in section 4.3: o equipment provisions o role of instrumentation o organizational responsibilities o on-site communication interfaces and external interfaces, if necessary Licensees should also consult REGDOC-2.12.1, High-Security Sites: Nuclear Response Force, and G-274, Security Programs for Category I or II Nuclear Material or Certain Nuclear Facilities for further information	the accident management program. This is an on-going assessment, e.g., insights and lessons from Fukushima, and the consideration and practical elimination of BDBA challenges to containment is under constant review. As part of PRA, severe accident analysis is performed for representative sequences, which includes a realistic assessment of mitigating provision capability. As part of SAMG strategy development and FAI follow-up, understanding of severe accident phenomena and reactor-specific physical processes, such as core degradation, in-vessel core debris retention, ex-vessel corium spreading and coolability, molten fuel coolant interaction, molten core concrete interaction, and all known containment challenge mechanisms is included in Technical Basis Documents. Implementation of SAMG improvements identified in COG JP-4426 addresses multi-unit events, in-vessel retention, hydrogen management and IFB. SAMG strategies address multiple approaches to accident management, including preventative and mitigative strategies. In addition EME guidance has been provided to prolong and restore power and heat sinks. In addition, the guidance identifies various additional considerations for an integrated accident management program for which it is considered there is indirect compliance: targeted stress tests; effectiveness of the most suitable or preferable measures for each reactor damage state assessed and documentation in detail; use of PRA to verify SAMG effectiveness, specification of time periods, and scenarios for training and drills; control of contaminated run-off water to the environment. For	

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	regarding security aspects of accident management.	targeted stress tests, CNSC correspondence NK29-CORR-00531-10246, CNSC Public Meeting of August 15, 2012, communicated an Update on the CNSC Action Plan: Lessons Learned from the Fukushima Nuclear Accident, and which selected a total station blackout event for the purposes of a stress test assessment. With respect to assessing the "effectiveness of the most suitable or preferable measures for each reactor damage state assessed and documentation in detail", this was accomplished and documented in the SAMG Technical Basis Documents updates through COG JP-4426, specifically COG-JP-4426-025 - Technical Basis Document - Volume 1 and COG-JP-4426-026 - Technical Basis Document - Volume 2. With respect to "use of PRA to verify SAMG effectiveness, specification of time periods, and scenarios for training and drills; and control of contaminated run-off water to the environment, The PRA consequence analysis described in COG report COG-JP-4426-026, together with the containment response, was used to identify the nature of challenges that must be mitigated by SAMG. In addition, the severe accident analyses from the Level 2 PRA, namely MAAP code runs, were used in the development of severe accident drill scenarios. Finally, consideration on how to contain contaminated run-off from the spent fuel bay is address in various SAMG Enabling Instructions which are being validated.	
4.3	Additional important elements that should be considered in the development of integrated accident	(All of 4.3 clauses) For non-emergency situation, operating procedure and AIMs effectively meet this	C

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	management include equipment and instrumentation, organizational responsibilities, and communication interfaces.	guidance. The SAMG, EMEG, and BPNERP and supporting documentation addresses it for severe accident situations and station emergencies.	
5.	To satisfy the requirements specified in section 3 pertinent to the implementation of integrated accident management, the licensee should consider the guidance given in this section. Implementation of accident management measures should consider, but not be limited to: o integration of procedures, guidelines, and arrangements to ensure that interfacing issues are addressed and that accident management components are put in place to meet the goals of accident management o verification of the procedures and guidelines to ensure that they work as intended o consideration of human factors and human-machine interface issues to ensure that the required accident management actions can be implemented as intended o organizational aspects to ensure that the defined responsibility matrix is consistent with the qualifications and expertise of the staff and with other authorities and supporting organizations o personnel training to ensure that a training	(All of section 5) The elements of an integrated accident management program are integrated in the sense that it is clear which procedure or guide is to be used under a given situation, with appropriate interfaces. These are verified through various approaches, depending on their use. Organizational authorities are defined for all categories of events. The required number of staff are defined based on the need to execute the accident management program elements. Training for all staff involved in accident management follows a SAT approach. Exercises and drills are defined and evaluated and used to improve the program. Simulators are used according to the event being trained. Evaluators are used to assess performance and obtain feedback.	C

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	plan is executed		
6.	To satisfy the requirements specified in section 3 pertinent to the validation of integrated accident management, the licensee should consider the guidance given in this section. The first step of the validation is to review the integrated accident management approach to assess its completeness and adequacy. The review also gives an opportunity to identify specific areas in accident management that need improvement to enhance reactor capabilities to cope with an accident. The adequacy of the SSCs and human/materiel resources that are required to complete accident management actions should be assessed. To ensure the continued effectiveness of accident management, the licensee should have a procedural mechanism (see requirement 6 in section 3.2) by which its components are continuously reviewed to ensure that the technical basis remains sound and current, and that station staff can carry them out effectively. Where the review indicates that improvements are required, those improvements should be incorporated promptly.	(All of 6) Review mechanisms are provided from OPEX, audits and assessments, including self-assessments and independents audits. In addition periodic reviews of safety analysis and risks are performed. The recent COG JP4426 provided an opportunity to review the SAMG program in light of experience and recent developments. As a result further studies (e.g., instrument and equipment survivability assessments, in-vessel retention and containment protection strategies, plant habitability assessments, and EMEG were performed).	C
7.	To satisfy the requirements specified in section 3 pertinent to the documentation of integrated accident management, the licensee should consider the	The documentation attributes of an IAMP are met for individual elements. However, an overarching “IAMP” document does not exist. Given the historical basis of	AD

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	following guidance. Aspects of accident management should be described by a suite of accident management documents consisting of manuals, procedures, guidelines together with their technical basis and supporting safety analysis reports for justifications, explanations, verification and validation. There are also other related documents such as description of the reactor physical protection, PSA studies, equipment and instrumentation survivability assessments, and reactor "stress test" reports as appropriate. At a minimum, the licensee should provide the following documented information: o goals and principles used for development and implementation of the accident management o technical basis and results of probabilistic and deterministic analyses conducted in support of accident management o EOPs, EMEGs if applicable, and SAMGs o performance capabilities for the systems and equipment that are used in support of accident management procedures and actions o responsibilities of persons and organizations	the current programs, this is considered an acceptable deviation.	

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	involved in accident management, including requirements and plans for personnel training o results of the accident management validation and reviews The technical basis documents provide technical information important to the identified accident management measures. They can build on or provide a cross-reference to the existing technical descriptions. They should include, but not be limited to: o justification of accident selection and coverage, including a general description of reactor response to accidents o distinct stages of an accident progression if no accident management actions are credited o understanding of phenomena and the associated physical processes, including challenges to fission product barriers and the associated mechanisms and conditions o state of the current knowledge of the phenomena, including current predictive capabilities for modeling the phenomena and physical processes and analytical and experimental supports o other aspects or special topics important to EOP and SAMG development and verification Reviews and revisions of the accident management		

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	documents should be tracked and controlled.		