FORM-14159 R000*

Periodic Safety Review - Final Document Review Traveler

Bruce Power

Bruce Power Document #:	Revision:	Information Classification	Usage Classification
NK21-SFR-09701-00002	R000	Internal Use Only	Information

Bruce Power Document Title:
Safety Factor 2 – Actual Condition of Structures Systems and Components

Bruce Power Contract/Purchase Order:	Bruce Power Project #:
00193829	38180

Supplier's Name:	Supplier Document #:	Revision:
CANDESCO	K-421231-00012	R00

Supplier Document Title:
Safety Factor 2 – Actual Condition of Structures Systems and Components

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

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

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candesco
Division of Kinectrics Inc.

Title: Safety Factor 2 - Actual Condition of SSCs

File: K-421231-00012-R00

NK21-SFR-09701-00002

A Report Submitted to Bruce Power

June 30, 2015

Issue	Reason for Issue:				
R00D0	For first internal Candesco review				
	Author: D. Rennick	Verifier:	Reviewer: G. Archinoff T. Kapaklili J. Sobolewski	Approver:	Date: Dec 9, 2014
Issue R00D1	**Reason for Issue:** For harmonization, which incorporates internal Candesco review comments				
	Author: D. Rennick	Verifier:	Reviewer: G. Archinoff J. Sobolewski	Approver:	Date: Feb 2, 2015
Issue R00D2	**Reason for Issue:** For final internal Candesco review				
	Author: D. Rennick	Verifier:	Reviewer: G. Archinoff L. Watt	Approver:	Date: Mar 3, 2015
Issue R00D3	**Reason for Issue:** Issued to Bruce Power for review				
	Author: D. Rennick	Verifier: G. Buckley	Reviewer: G. Archinoff L. Watt	Approver:	Date: Mar 13, 2015

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

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Acronyms and Abbreviations

AIA	Authorized Inspection Agency
ALPO	Asset Life Projections & Options (occasionally seen as ALP&O)
AMOT	Asset Management Options Template
AOP	Ageing and Obsolescence Project
APRV	Auxiliary Pressure Relief Valve
ARM	Alarm Response Manual
ASME	American Society of Mechanical Engineers
BDBA	Beyond Design Basis Accident
BDBE	Beyond Design Basis Event
BP	Bruce Power
BPIP	Buried Piping Inspection Program
BPMS	Bruce Power Management System (commonly referred to as MSM)
CA	Condition Assessment
CANDU	CANada Deuterium Uranium
CAPR	Corrective Action to Prevent Recurrence
CAR	Condition Assessment Report
CCS	Concrete Containment Structure
CER	Control Equipment Room
CHR	Component Health Report
CMP	Control Maintenance Procedures
CNSC	Canadian Nuclear Safety Commission
COG	CANDU Owners Group
CPMP	Component Performance Monitoring Plan
CSA	Canadian Standards Association
CSTA	Calandria and Shield Tank Assembly
DBA	Design Basis Accident
DCC	Digital Control Computer
DSC	Dry Storage Container
EA	Environmental Assessment

ECI	Emergency Coolant Injection
EFADS	Emergency Filtered Air Discharge System
ELCE	Equipment Life Cycle Engineering
EME	Emergency Mitigating Equipment
EOL	End of Life (projection)
EPRI	Electric Power Research Institute
EQ	Environmental Qualification
ER	Equipment Reliability
ERCOE	Equipment Reliability Centre of Excellence
ERI	Equipment Reliability Integration
F&P	Fischer and Porter
FAGM	Fixed Area Gamma Monitor
FAI	Fukushima Action Item
FLMP	Fluid Leak Management Program
FMEA	Failure Modes & Effects Analysis
GFP	Gaseous Fission Product
HX	Heat Exchanger
I&C	Instrumentation and Control
IAEA	International Atomic Energy Agency
IFB	Irradiated Fuel Bay
IM	Safety Systems Impairments Manual
IMMR	Inspection, Monitoring & Maintenance Review
INPO	Institute of Nuclear Power Operations
INSAG	International Nuclear Safety Advisory Group
IPRV	Instrumented Pressure Relief Valve
ISR	Integrated Safety Review
IUC	Instrument Uncertainty Calculations
JIT	Just In Time
LCH	Licence Conditions Handbook
LCM	Life Cycle Management
LCMP	Life Cycle Management Plan

LISS	Liquid Injection Shutdown System
LOCA	Loss of Coolant Accident
LTEP	Long Term Energy Plan
M&TE	Measuring & Testing Equipment
MCR	Major Component Replacement
MEL	Master Equipment List
MMCC	Modification/Maintenance Completion Certificate
MMP	Mechanical Maintenance Procedures
NBIC	National Board Inspection Code
NPP	Nuclear Power Plant
NSCA	Nuclear Safety and Control Act
NUMAC	Nuclear Maintenance Applications Center
NUOG	Nuclear Utility Obsolescence Group
NuSCI	Nuclear Subject Classification Index
OFI	Opportunities for Improvement
OPEX	Operating Experience
OSR	Operational Safety Requirements
OVR	Obsolescence Value Ranking
PAM	Pro-Active Maintenance
PARMS	Post Accident Radiation Monitoring System
PdM	Predictive Maintenance
PHT	Primary Heat Transport
PI	Plant Information (System)
PIFB	Primary Irradiated Fuel Bay
PIP	Periodic Inspection Program
PM	Preventive Maintenance
PMC	Project Management and Construction (a division of Bruce Power)
PMCR	PM Change Request
PMEL	Performance Monitoring Equipment List
PMP	Performance Monitoring Plans
POMS	Proactive Obsolescence Management System

PROG	Bruce Power Program
PROL	Power Reactor Operating Licence
PRV	Pressure Relief Valve
PSR	Periodic Safety Review
QA	Quality Assurance
QPS	Qualified Power Supply
RCE	Responsible Component Engineer
RDE	Responsible Design Engineer
RD/GD	Regulatory Document/Guidance Document
RSE	Responsible System Engineer
RV	Relief Valve
SBR	Safety Basis Report
SCA	Safety and Control Area
SCR	Station Condition Record
SF	Safety Factor
SFR	Safety Factor Report
SHIP	System Health Improvement Plan
SHR	System Health Report
SIFB	Secondary Irradiated Fuel Bay
SIS	Systems Important to Safety
SME	Subject Matter Expert
SOE	Safe Operating Envelope
SPHC	Station Plant Health Committee
SPMP	System Performance Monitoring Plan
SPV	Single Point of Vulnerability
SSC	Structure, System and Component
SSG	Specific Safety Guide
SST	Safety System Testing
TBA	Technical Basis Assessment
TOE	Technical Operability Evaluation
TSSA	Technical Standards and Safety Authority

WANO World Association of Nuclear Operators

1. Objective and Description

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

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

1.1. Objective

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

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

and improvement of safety culture and the achievement of high levels of safety, as well as reliable and economic performance.

The specific objective of the review of this Safety Factor is to determine the actual condition of Systems, Structures and Components (SSCs) important to safety and whether it is adequate for them to meet their design requirements. In addition, the review should confirm that the condition of SSCs is properly documented.

1.2. Description

The review is conducted in accordance with the Bruce A ISR Basis Document [1], which states that the review tasks will include examination of the following aspects for the selected SSCs:

1. Existing or anticipated ageing processes;
2. Operational limits and conditions;
3. Current state of the SSC with regard to its obsolescence;
4. Implications of changes to design requirements and standards on the actual condition of the SSC since the plant was designed or since the last PSR (for example, changes to standards on material properties);
5. Plant programs that support ongoing confidence in the condition of the SSC;
6. Significant findings from tests of the functional capability of the SSC;
7. Results of inspections and/or walkdowns of the SSC;
8. Maintenance and validity of records;
9. Evaluation of the operating history of the SSC;
10. Dependence on obsolescent equipment for which no direct substitute is available;
11. Dependence on essential services and/or supplies external to the plant;
12. The condition and operation of spent fuel storage facilities and their effect on the spent fuel storage strategy for the nuclear power plant; and
13. Verification of the actual state of the SSC against the design basis.

2. Methodology for Review

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

- Return to service of Bruce Units 3 and 4 (circa 2001) [7];
- Life extension of Bruce Units 1 and 2 (circa 2006) [8] [9];

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

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

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

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

   The final assessment types are identified in Section 3, along with the rationale for any changes relative to the assignment types listed in the ISR Basis Document
4. **Perform gap assessment against codes and standards:** This step comprises the actual assessment of the Bruce Power programs and the Bruce A plant against the identified codes and standards. In general, this involves determining from available design or programmatic documentation whether the plant's design or programs meet the provisions of the specific clause of the standard or of some other criterion, such as a summary of related clauses. Each individual deviation from the provisions of codes and standards is referred to

as a Safety Factor “micro-gap”. The assessments, performed in Appendix A and Appendix B, include assessor’s arguments conveying reasons why the clause is considered to be met or not met, while citing appropriate references that support this contention.

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

3. Applicable Codes and Standards

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

3.1. Acts and Regulations

The *Nuclear Safety and Control Act* (NSCA) [14] establishes the Canadian Nuclear Safety Commission and its authority to regulate nuclear activities in Canada. The NSCA has been amended on July 3, 2013 to provide the CNSC with the authority to establish an administrative monetary penalty system. The Administrative Monetary Penalties Regulations were introduced in 2013, and set out the list of violations that are subject to administrative monetary penalties, as well as the method and criteria for penalties administration. However, these changes do not impact this Safety Factor. Furthermore, following the Fukushima nuclear events of March 2011, the Fukushima Omnibus Amendment Project was undertaken and completed in 2012, and resulted in amendments to regulatory documents to reflect lessons learned from these events. Bruce Power has a process to ensure compliance with the NSCA [14] and its Regulations. Therefore, the NSCA and Regulations were not considered further in this review.

3.2. Power Reactor Operating Licence

The codes and standards related to Actual Condition of SSCs that are referenced in the Bruce Power Reactor Operating Licence (PROL) [15] and Licence Conditions Handbook (LCH) [16] are identified in Table 1.[2] The edition dates referenced in the third column of the table are the modern versions used for comparison.

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

Document Number	Document Title	Modern Version used for ISR Comparison	Type of Review
CNSC RD-360	Life Extension of Nuclear Power Plants	CNSC RD-360 (2008) [4]	NR
CNSC S-98	Reliability Programs for Nuclear Power Plants	CNSC RD/GD-98 (2012) [17]	NR
CSA-N285.4-05	Periodic Inspection of CANDU Nuclear Power Plant Components	CSA-N285.4-14 [19]	NR

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

Document Number	Document Title	Modern Version used for ISR Comparison	Type of Review
CSA N286-05	Management System Requirements for Nuclear Power Plants	CSA N286-12 [20]	NR
CSA N286.7-99	Quality Assurance of Analytical, Scientific and Design Computer Programs for Nuclear Power Plants	CSA N286.7-99 (R2012) [21]	NR
CSA N290.13-05	Environmental Qualification of Equipment for CANDU Nuclear Power Plants	CSA N290.13-05 (R2010) [22]	NR
CSA N290.15-10	Requirements for the safe operating envelope of nuclear power plants	CSA N290.15-10 [23]	NR
Assessment type: Clause-by-Clause (CBC); Code-to-Code (CTC); High Level (HL); No Assessment Required (NR); Confirm Validity of Previous Assessments (CV)			

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

CNSC RD/GD-98: Table C-1 of the ISR Basis Document [1] calls for a confirmation of validity of the previous reviews of Regulatory document RD/GD-98 [17], Reliability Programs for Nuclear Power Plants, which sets out the requirements and guidance of the CNSC for the development and implementation of a reliability program for nuclear power plants in Canada. RD/GD-98 [17] captures the existing requirements previously found in the eponymous S-98 (Revision 1) [24] and also replaces the latter document. A review against S-98 was completed for the Bruce 1 and 2 ISR and submitted to the CNSC and the program was established and implemented as required by licence condition 4.4 of the PROL [15]. However, RD/GD-98 does not add to the requirements of S-98 [13] and continues to be a licence condition. Line-by-line compliance with this regulatory document is verified on an ongoing basis to ensure compliance with the PROL, and therefore it was not assessed as part of this Safety Factor.

CSA N285.4: CSA N285.4 was not identified as relevant for Safety Factor 2 in Table C-1 of the ISR Basis Document [1]. CSA N285.4, Periodic Inspection of CANDU Nuclear Power Plant Components is listed as condition 4.3(i) (a) in the PROL [15]. A high level review of the 2005 version of this standard was performed as part of the Bruce 3&4 ISR. A newer version of this standard was issued in 2009 [25] with an Update in 2011; the CNSC has indicated that the 2009 version with the 2011 Update will be included in the next PROL [26]. Since Bruce Power verifies line-by-line compliance with this standard on an ongoing basis to ensure compliance with the PROL, the 2009 version will be subject to a transition plan and compliance was not assessed as part of this ISR. However, the latest version of this standard is N285.4-14. A high level code-to-code comparison between the 2014 and 2009 versions was conducted and the results are presented in Safety Factor 4.

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

Bruce Power had agreed to perform a Gap Analysis and to prepare a detailed Transition Plan, and to subsequently implement the necessary changes in moving from the CSA N286-05 version of the code to the CSA N286-12 version, during the next licensing period [28]. This timeframe will facilitate the implementation of N286 changes to the management system, and enable the gap analysis results from the large number of new or revised Regulatory Documents or Standards committed in the 2015 operating licence renewal. Bruce Power has also proposed that in the interim, CSA N286-05 be retained in the PROL to enable it to plan the transition to CSA N286-12, and committed to develop the transition plan and communicate the plan to the CNSC by January 30, 2016 [29]. Bruce Power further stated CSA N286-12 does not establish any significant or immediate new safety requirements that would merit a more accelerated implementation. This Safety Factor therefore has not performed a code-to-code assessment between CSA N286-05 and CSA N286-12 and will not be performing a clause-by-clause assessment of CSA N286-05, since it is in the current licence.

CSA N286.7-99: CSA N286.7 is included as a requirement in the PROL [15], and therefore subject to an ongoing compliance review in a Bruce Power process [30]. Therefore, review against this standard was not required as part this Safety Factor.

CSA N290.13-05: CSA N290.13-05 [22] provides environmental qualification requirements for the design of CANDU Nuclear Power Plant (NPPs). It is of relevance to deterministic safety analysis, since assumed system credits in safety analysis are supported by environmental qualification. The safety analysis of Design Basis Accidents (DBAs) only credits equipment qualified to withstand the harsh environment resulting from such accidents. This standard that was used for the Bruce 1&2 ISR has not been revised and the standard is in the licence. Table C-1 of the ISR Basis Document [1] calls for the confirmation of validity of the previous assessment. However, CSA N290.13-05 is currently listed in the licence, and thus no further assessment is required.

CSA N290.15-10: CSA N290.15 is included in the current LCH [16] and is therefore part of the current licensing basis. Bruce Power contributed extensively to the formulation of this standard and so the major elements are in place and have been throughout the Unit 1 and 2 and Units 3 and 4 reviews (see Section 5.3 for a chronology of the development of N290.15). Full compliance with this standard is included in ongoing dialogue with the CNSC and is the subject of a transition plan [30]. The expectation is that Bruce Power will be compliant by September 2015 [31]. Therefore, there is no further discussion on this standard in this Safety Factor Report.

3.3. Regulatory Documents

There were no additional Regulatory Documents identified in Table C-1 of the ISR Basis Document [1] considered for application to review tasks of this Safety Factor beyond those identified in the PROL [15] and LCH [16].

3.4. CSA Standards

The Canadian Standards Association (CSA) has issued standards that form the basis of the Quality Assurance (QA) programs for all Canadian nuclear facilities. These high-level documents are used primarily as a foundation or basis on which nuclear utility operators have developed specific, internal policies, programs, and procedures. The CSA Standards listed in Table 2 are relevant to Actual Condition of SSCs.

Table 2: CSA Standards

Document Number	Document Title	Reference	Type of Review
CSA B51-14	Boiler, Pressure Vessel, and Pressure Piping Code	[32]	NR
CSA N291-08 (R2013)	Requirements for Safety-Related Structures for CANDU Nuclear Power Plants	[33]	HL
Assessment type: Clause-by-Clause (CBC); Code-to-Code (CTC); High Level (HL); No Assessment Required (NR); Confirm Validity of Previous Assessments (CV)			

CSA B51-14: Table C-1 of the ISR Basis Document [1] calls for a code-to-code assessment of CSA B51-14. However, CSA B51 is incorporated in the regulatory structure because this standard is called directly by CSA N285, which is in the Bruce A PROL and subject to a transition plan. Therefore, no further review of CSA B51 is needed in support of this assessment.

CSA N291-08: Table C-1 of the ISR Basis Document [1] calls for a clause-by-clause assessment of CSA N291-08. Bruce Power's position is that CSA N291-08 largely provides recommendations and guidance [30]. Moreover, many of its requirements would be a backfit that is inconsistent with the already designed, built and operated plant. Notwithstanding this, Bruce Power continues to support the CANDU Owners Group (COG) Research Program on alternative materials (e.g., page 43 of [34]) that would be acceptable for revitalization or modification of existing structures that might not otherwise comply with the recently issued standard (compared to the original design and construction dates). As such, a high level review of CSA N291-08 is more appropriate, and this is provided in Appendix A (A.1).

3.5. International Standards

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

Table 3: International Standards

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

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

3.6. Other Applicable Codes and Standards

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 Bruce Power Programs and Processes

Bruce Power implementation documents related to Condition Assessment, Fitness for Service, System Health Reporting and Life Cycle Management (LCM) have become more detailed and extensive in response to industry and corporate initiatives to better understand and continuously improve. These improvements reflect Bruce Power's asset management initiatives, as well as alignment with best industry practices and CNSC expectations. The implementing documents relevant to Safety Factor 2 are listed in Table 4.[3] It is recognized there is some overlap with Safety Factor 4 on Ageing, as Asset Management and Ageing Management are integrated. The condition of the SSCs and knowledge of how they change with age is integrated to determine the improvements needed to manage the assets. Reference [35] is a description of the principles of Asset Management as the Asset Management initiative ramped up.

Table 4: Implementing Documents

First Tier Documents	Second Tier Documents	Third Tier Documents	Fourth Tier Documents
BP-MSM-1: Management System Manual [36]	BP-PROG-00.04: Pressure Boundary Quality Assurance Program [37]		
	BP-PROG-10.01: Plant Design Basis Management [38]	BP-PROC-00335: Design Management [45]	BP-PROC-00261: Environmental Qualification [60]
		BP-PROC-00582: Engineering Fundamentals [46]	
	BP-PROG-11.01: Equipment Reliability [39]	BP-PROC-00268: Safety System Testing (SST) Program Procedure [47]	

[3] Table 4 lists the key governance documents used to support the assessments of the review tasks for this Safety Factor Report. There is a continual process to update the governance documents; document versions may differ amongst individual Safety Factor Reports depending on the actual assessment review date. A full set of current sub-tier documents is provided within each current PROG document.

First Tier Documents	Second Tier Documents	Third Tier Documents	Fourth Tier Documents
		BP-PROC-00383: Performance and Condition Assessment [48]	
		BP-PROC-00400: Life Cycle Management of Aging Components [49]	BP-PROC-00334: Periodic Inspection [61]
		BP-PROC-00533: Obsolescence Management [50]	BP-PROC-00532: Critical and Strategic Spares [62]
		BP-PROC-00534: Technical Basis Assessment [51]	
		BP-PROC-00666: Component Categorization [52]	
		BP-PROC-00778: Scoping and Identification of Critical SSCs [53]	
		BP-PROC-00779: Continuing Equipment Reliability Improvement [54]	BP-PROC-00457: Development and Approval of Predefined [63]
			BP-PROC-00498: Condition Assessment of Generating Units in Support of Life Extension [64]

First Tier Documents	Second Tier Documents	Third Tier Documents	Fourth Tier Documents
		BP-PROC-00780: Preventive Maintenance Implementation [55]	BP-PROC-00501, Integrated Preventive Maintenance Program, [65]
		BP-PROC-00781: Performance Monitoring [56] [4]	BP-PROC-00267: Management of Steam Generator and Preheater Tube Integrity [66]
			BP-PROC-00284: Predictive Maintenance [67]
			BP-PROC-00361: In-Service Testing and Inspection to Satisfy CSA N287.7-08 Requirements [68]
			BP-PROC-00387: Plant Inspection [69]
			BP-PROC-00825: Buried Pipe Inspection Program [70]
			BP-PROC-00849: Aggregate Risk Assessment and Monitoring [71]
			BP-PROC-00863: Engineering Programs Health Reporting [72]

[4] BP-PROC-00382 has been superseded by BP-PROC-00781.

First Tier Documents	Second Tier Documents	Third Tier Documents	Fourth Tier Documents
			BP-PROC-00893: Fuel and Fuel Channel Program [73]
			BP-PROC-00923: Pipe Wall Thinning - FAC Procedure (Replaces SEC-ME-00007 [74]) [75]
			DPT-PE-00008: System and Component Performance Monitoring Plans [76]
			DPT-PE-00009: System and Component Performance Monitoring Walkdowns [77]
			DPT-PE-00010: System Health Reporting [78]
			DPT-PE-00011: Component Health Reporting [79]
			SEC-ME-00008: Heat Exchangers [80]
			SEC-ME-00010: Inspection and Monitoring Once-Through Service Water Systems [81]
			SEC-RE-00017: Motor Program [82]

First Tier Documents	Second Tier Documents	Third Tier Documents	Fourth Tier Documents
		BP-PROC-00782: Equipment Reliability Problem Identification & Resolution [57]	
		BP-PROC-00783: Long Term Planning & Life Cycle Management [58]	
	BP-PROG-11.02: On-Line Work Management [40]		
	BP-PROG-11.03: Outage Work Management [41]		
	BP-PROG-11.04: Plant Maintenance [42]	BP-PROC-00699: Maintenance Work [59]	BP-PROC-00694: Maintenance Procedure Development and Revision (Replaces SEC-MSS-00004, [83]), [84]
	BP-PROG-12.02: Chemistry Management [43]		
	BP-PROG-12.03: Fuel Management [44]		

BP-MSM-1 [36][5], the Bruce Power Management System Manual (BPMS), describes the way Bruce Power manages the Company. It represents the highest tier document in the governing document structure. It acts as an overall framework to understanding and using the lower tier documents. It establishes the programs that enable the performance of all business activities.

Nuclear Safety is a primary consideration for Bruce Power; therefore the management system supports the enhancement and improvement of safety culture. The BPMS is designed to ensure that the Bruce Power leadership team can consistently deliver expected results and satisfy key stakeholders, such as the regulators, the public, its shareholders and employees. It ensures that Bruce Power meets the stipulations of its operating licences, applicable codes, standards, legal and business requirements.

The BPMS establishes a nuclear safety culture[6] that assures reactor, environmental, industrial and radiological safety. It provides the necessary guidance for making risk based decisions that satisfy the desired balance between safety, commercial, corporate reputation and other performance requirements. No single element of the BPMS operates independently; all parts of the System are interconnected and interdependent. The BPMS includes ongoing assessment and continuous improvement of system effectiveness.

Bruce Power Programs (PROGs) implement the BPMS and define requirements. They are specific to functional areas and establish measures for compliance and execution. Programs are driven by regulatory and business requirements. They are applicable across Bruce Power.

Bruce Power Procedures and Processes define how work is performed. A procedure resides below the Program level in the document hierarchy and consists of a structured set of activities designed to produce an output or it may be an informational document that establishes a standard, expectation or other requirement. As for programs, standardization of procedures/processes is required across Bruce Power.

In addition to general procedures, Bruce Power uses station system procedures that require application of a Nuclear Subject Classification Index (NuSCI). Station system procedures, which are principally technical in nature, are intended to facilitate the creation of operating, maintenance, and engineering type procedures requiring alignment to plant structures, systems and components.

The Bruce Power Programs and the procedures supporting them pertinent to Actual Condition of SSCs (where appropriate) are described in the following subsections.

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[5] Revision 011 was used for the previous Safety Factor 2 assessment [2]. The overall objective and commitment to safe operation continue in Revision 012. In the context of this assessment, one important update was to extend operational safety to both normal operations and extreme events, consistent with WANO SOER-2013-2 (Fukushima Lessons Learned). Other than this conceptual change, the review of Revision 012 changes did not identify any changes affecting condition assessment.

[6] In support of the objective of the extension of the MSM to extreme events, BP-MSM-1 Revision 012 included an amendment to specify that "… nuclear safety culture is applicable to normal operations and extreme events".

4.1. Pressure Boundary Quality Assurance Program, BP-PROG-00.04

BP-PROG-00.04 [37], Pressure Boundary Quality Assurance Program, describes the Bruce Power program to control the quality of pressure boundary activities at the facilities described in Section A of the Program manual. It complies with the applicable rules and quality assurance requirements contained in CSA Standards: a) N285.0 and supporting codes for Class 1, 1C, 2, 2C, 3, 3C, 4 and 6 systems and components, and b) B51 and supporting codes for Class 6 and unclassified registered systems and components.

Pressure boundary activities at the stations are performed in accordance with the Codes and Standards required by the Bruce A PROL [15][16]. Organizations that support pressure boundary work at Bruce A and B comply with the requirements established in the approved Pressure Boundary Quality Assurance Program. BP-PROG-00.04 is relevant to “Safety Factor 1: Plant Design”. In the context of Safety Factor 2, the PBQA Program is the top level governance for inspection activities and therefore relevant to Condition Assessment of SSCs important to safety.

The current revision of BP-PROG-00.04 is R020; the revision previously reviewed was R019. Therefore a review of the changes made to upgrade from R019 to R020 was made. An examination of the Revisions block of R020 showed changes related mostly to organizational positions; because Bruce Power processes continuously transition to licence requirements, a substitution of American Society of Mechanical Engineers (ASME) Section III for ASME NQA-1 throughout would not affect the conclusions of previous reports in the context of condition assessments. Therefore, the previous PSR/ISR reviews of BP-PROG-00.04, which did not identify any gaps, are still valid. An electronic comparison with the previous revision showed no other technical differences.

4.2. Plant Design Basis Management Program, BP-PROG-10.01

BP-PROG-10.01 [38], Plant Design Basis Management, defines the overall business need, constituent elements, functional requirements, implementing procedures and key responsibilities associated with the plant's Design Basis.

The overall objective of Plant Design Basis Management is to ensure that the SSCs important to safety have the appropriate characteristics, specifications and material composition to perform their safety functions and the plant can operate safely and reliably for the duration of its design life[7], with accident prevention and the protection of workers, the public and the environment as prime goals. The objective of this program is to define, document and control changes to the Design Basis to maintain the Design Basis within margins and regulatory requirements and to

[7] The assessment of remaining design life is closely tied to Bruce Power’s Asset Management project to determine whether the design life can be extended or the component requires replacement (and strategically when, from a schedule and business planning perspective). The project has deployed a wide range of tools, inspections, and assessments such as AOP (Ageing and Obsolescence Program), ALP&O (Asset Life Projection and Options), AMOT (Asset Management Options Template) culminating in the LCMP (Life Cycle Management Plan). See discussion of BP-PROC-00400.

perform Safety Analysis to show that the plant operation conforms to the Design Basis and Licensing Basis (e.g., requirements, assumptions, regulatory submissions) while remaining within the agreed acceptance criteria and bounds of analyzed conditions and the Safe Operating Envelope (SOE).

Plant design of SSCs is in accordance with design requirements and work activities are planned and controlled. Design work activities are authorized and performed using approved processes, documents, materials, parts, tools and practices. Verification of work activities is planned before work activities commence. Verification includes who is to conduct the verification and outlines both the verification method and acceptance criteria. The analysis supporting the design provides a robust demonstration of the fault tolerance, adequacy and effectiveness of the operating and safety systems under the full range of operating and DBA conditions.

The SOE and licensing conditions are defined and managed to provide clear direction to individuals engaged in the design, operation, analysis and licensing of the plant so they understand the operating limits and conditions of the plant that have been analyzed to be safe.

BP-PROG-10.01 is relevant to “Safety Factor 1: Plant Design” so the review of its adequacy is addressed in Safety Factor 1.

4.3. Equipment Reliability Program, BP-PROG-11.01

This section describes the Equipment Reliability Program and its supporting procedures pertinent to Condition Assessment. Equipment Reliability has been, and continues to be, a major initiative and priority at Bruce Power over the last few years.

BP-PROG-11.01 [39], Equipment Reliability[8], defines the fundamental business need, constituent elements, functional requirements, implementing approaches and key responsibilities associated with the plant equipment reliability integration process. The objectives of the Equipment Reliability Program process are to ensure:

- The process is efficient, incorporates human factor considerations, and ensures effective performance during all phases of plant operations;
- A uniform process is used among all plants in the organization;
- Applicable in-house and industry lessons learned are incorporated into the process to improve adequacy and efficiency; and
- Changes to the process are timely, responsive to user feedback, and implemented at all affected plants.

Through the procedures described below in this report, BP-PROG-11.01 drives the inspection, testing, surveillance and maintenance activities that provide the information and assessments to understand and document the condition of SSCs Important to Safety. Appendix B of BP-PROG-11.01 is a chart showing the organization of the supporting procedures.

[8] This was reviewed as part of CNSC Bruce A Action Item 090711.

Appendix C of BP-PROG-11.01 contains a useful cross reference matrix of the regulatory requirements and where the requirements are fulfilled in the various sub-tier procedures that support Equipment Reliability – in effect a mini compliance matrix. It lists the relevant regulatory requirements, identifying which of the six implementing procedures addresses which part of these regulations. A salient comment and solid recognition of management principles included in the first row of the matrix is that “The ER program and its implementing procedures are structured to address the 14 management system principles of N286-05.”

The key driving procedures selected by Engineering in the aforementioned matrix for Equipment Reliability to establish compliance with major regulatory documents are the following:

- BP-PROC-00778, Scoping and Identification of Critical SSCs
- BP-PROC-00779, Continuing Equipment Reliability Improvement
- BP-PROC-00780, Preventative Maintenance Implementation
- BP-PROC-00781, Performance Monitoring
- BP-PROC-00782, Equipment Reliability Problem Identification & Resolution
- BP-PROC-00783, Long Term Planning & Life Cycle Management

4.4. On Line Work Management Program, BP-PROG-11.02

BP-PROG-11.02 [40], the On-Line Work Management Program, defines the fundamental business need, constituent elements, functional requirements, implementing approaches and key responsibilities associated with On-Line Work. Its objective is to provide timely identification, selection, prioritization, approval, scheduling and coordination to allow execution of work necessary to ensure safety and to maximize the availability and reliability of SSCs. The program takes into account the risks associated with conducting work. It identifies the impact of work to the station and to work groups; and protects the station from unanticipated transients due to the execution of work. The objective of the On-Line Work Management Program is to support nuclear safety and foster a nuclear safety culture through the incorporation of the following guiding principles and values:

- Provide timely identification, screening, scoping, planning, scheduling, preparation and execution of work necessary to maximize the availability and reliability of station equipment and systems;
- Manage the risk associated with work through the proactive identification of situations or activities that could jeopardize or adversely impact safety margins and enable the development of mitigation strategies;
- Identify the impact of work to the station and work groups, and protect the station from unanticipated transients that result from work; and
- Maximize the efficiency and effectiveness of station staff and material resources while sustaining safe, reliable and competitive plant operation at optimum cost to Bruce Power.

4.5. Outage Work Management Program, BP-PROG-11.03

BP-PROG-11.03 [41] the Outage Work Management program defines the fundamental business need and, constituent elements, functional requirements, and implementing approaches associated with Outage Work Management. The purpose is to identify the controls associated with planning, implementation, and control of work performed on a reactor unit when the unit is shutdown such that maintenance, inspections, and modifications are performed safely and on the basis of value to maintaining safe, reliable and lowest cost operation. This includes selecting and controlling the scope of work, planning, scheduling, coordinating work execution, and closing out the outage.

4.6. Plant Maintenance Program, BP-PROG-11.04

BP-PROG-11.04 [42], Plant Maintenance Program defines the fundamental business need, constituent elements, functional requirements, implementing approaches and key responsibilities associated with the management of the plant maintenance process. Its objective is to perform the hands-on maintenance of plant SSCs in accordance with approved maintenance strategies, schedules, procedures and practices in a cost effective manner that maximizes the availability and reliability of safety-related and production sensitive equipment, while ensuring the commitment to Nuclear Safety: Reactor, Radiation, Environmental and Industrial Safety, is maintained. The focus is on predictive and preventive maintenance to support enhanced equipment reliability and improved operational safety performance. Maintenance strategies are continually refined on a basis of improved technologies, Operating Experience (OPEX) and feedback from activities associated with plant reliability integration. Work selection, prioritization and response are guided by risk informed decision making. BP-PROG-11.04 is also relevant to “Safety Factor 4: Ageing”. Ageing is a significant contributor to operability of instrumentation and components and affects their material condition.

The previous assessment for Safety Factor 2 [2] used Revision 5 of BP-PROG-10.04. Since then, the PROG has been completely rewritten. Revision 6 responds to the audit AU-2013-00006, Maintenance [see Section 7.2.1.1]. The overall assessment of the revisions is that they do not affect the conclusions of this report.

BP-PROC-00261 [60], Environmental Qualification, establishes the authority for the Environmental Qualification (EQ) Process at the Bruce Power site. The EQ Process establishes an integrated and comprehensive set of requirements that provide assurance that credited essential equipment and components can perform their safety related functions if exposed to harsh environmental conditions resulting from DBAs, in accordance with the plant design and licensing basis and this capability is preserved over the life of both stations. The process supports the Plant Design Basis Management program BP-PROG-10.01. If a component deteriorates or has been inadvertently modified such that it does not meet its EQ requirements, it is unfit for service (impaired), the same as if it was an instrument out of calibration. BP-PROC-00261 is relevant to “Safety Factor 3: Equipment Qualification”.

BP-PROC-00267 [66], Management of Steam Generator and Preheater Tube Integrity, specifies the requirements for monitoring, integrating and assessing information on steam generator and preheater tubes and tube bundle structures and detailing their documentation requirements. It incorporates the reporting requirements associated with demonstrating compliance with design basis and licensing documentation. The Steam Generator Program Team is a forum for monitoring and evaluation of Steam Generator/Preheater related data, in conjunction with the Station Condition Records (SCRs) and Safety Report Update procedures. The team is a tool to ensure compliance with design requirements, licensing documents, safety analysis, operational and outage performance targets and business plans.

BP-PROC-00268 [47], Safety System Testing (SST) Program Procedure, defines the Safety Related System Testing program and lists the roles and responsibilities of stakeholders for testing the Safety Related Systems to ensure they remain available.

The SST program has been designed to meet the following primary objectives:

- Demonstrate that the special safety, safety support and standby safety systems meet their design targets for equipment reliability;
- Ensure that the requirements of Operating Policies and Principles are met;
- Provide information to notify the CNSC, as per the PROL, of Safety Related System component failures and impairments discovered by the testing program in accordance with S-98, Reliability Programs for Nuclear Power Plants, and REGDOC-3.1.1, Reporting Requirements for Nuclear Power Plants; and
- Provide meaningful failure rate data on Safety Related System operation.

The SST program is a requirement of the Bruce A (and Bruce B) PROLs. While this report focuses on Bruce A, inclusion of Bruce B is pertinent in some cases, particularly in the context of OPEX useful to Bruce A, Safety Factor 9.

BP-PROC-00284 [67], Predictive Maintenance, establishes the requirements to implement, maintain, and continuously improve a successful Predictive Maintenance (PdM) Program integrating various equipment condition monitoring technologies. These activities are performed in accordance with the approved maintenance strategy to assure early detection of deteriorating equipment conditions and to provide meaningful information to determine appropriate maintenance action thereby optimizing the overall component and system health.

The goals of the PdM Program are as follows:

- Provide component health status for all equipment monitored using PdM technologies;
- Prevent equipment failure through accurate analysis and timely corrective action;
- Improve equipment safety, reliability and availability by early detection of equipment degradation and by minimizing unplanned corrective maintenance;
- Where applicable, provide justification for extending the frequency of intrusive preventive maintenance;
- Increase lead time of notification for corrective or preventive maintenance;
- Verify that corrective action has produced the desired effect; and
- Determine optimum scope and frequency of PdM activities.

BP-PROC-00334 [61], Periodic Inspection, is performed to satisfy the requirements of Section 4.3 of the Bruce A PROL and associated LCH. As presently configured, inspections must comply with CSA N285.4-09 (with Updates 1&2 so effectively R2011), and CSA N285.5-08[9]. It describes how the requirements for a Periodic Inspection Program (PIP) of plant SSCs are established and documented through creating, updating and revising the Periodic Inspection Plans and Schedules. It documents the methods for review, evaluation and disposition of Periodic Inspection findings, as required and identifies the roles and responsibilities for PIP personnel.

The previous condition assessment review in the interim PSR [2] considered Revision 02 of BP-PROC-00334. In the interim, Revision 03 has been issued. It follows the same general principles, but has been reorganized to considerably strengthen alignment and/or compliance with Bruce Power governing procedures, and to better define roles and accountabilities. It provides a definition of Engineering scope for both CSA N285.4 and N285.5. Overall, there have been no major intent changes negatively affecting the compliance with the N285.4 or N285.5 standards, and therefore the results of assessment are the same or better.

BP-PROC-00361 [68], In-Service Testing and Inspection to satisfy CSA N287.7-08 Requirements [85], satisfies CSA N287.7-96 requirements and provides an outline of the In-Service Inspection, Examination and Testing Program required for monitoring and maintaining the structural integrity of the Bruce A Concrete Containment Structures (CCS) and their appurtenances during the operating life of the station.

The two main requirements of the Bruce A and B Containment Envelopes (or structures) are that they must:

- Withstand substantial changes in pressure and retain structural integrity when subjected to the higher of the design pressure or the peak Loss of Coolant Accident (LOCA) pressure; and
- Prevent or minimize radioactive releases out of containment in the event of a DBA.

To ensure that these requirements are met, the leak tightness and integrity of the containment envelope is tested and the containment structures inspected, examined, tested and maintained on a periodic basis.

BP-PROC-00383 [48], Performance and Condition Assessment (CA), provides the basis and expectations for the Performance and CA Process at Bruce Power, which supports the Equipment Reliability Program (BP-PROG-11.01). The scope of SSCs to be included in the CA Process is identified through the LCM Process (BP-PROC-00400), based on the impact of SSC failure on plant safety, reliability or economics. The data and information on plant SSCs, which are evaluated in the CA Process, are collected through the Performance and Condition Monitoring Process (BP-PROC-00781). BP-PROC-00383 is also relevant to “Safety Factor 4: Ageing”.

[9] Because N285.4 and N285.5 are included in the PROL, Bruce Power is presently also preparing transition plans to update PIP documents to comply with the CSA standard versions to 2014 and 2013, respectively. Adjustments to the subordinate procedures could ensue from that transition.

BP-PROC-00387 [69], Plant Inspection, governs inspection activities that must comply with statutory, regulatory, code or quality assurance requirements. Non-code related inspections may fall within the scope of this document if the means of executing them is similar to code inspections (e.g., in terms of qualified personnel, equipment or procedures).

Inspection activities associated with the execution of inspection tasks or inspection scope comply with this procedure including data acquisition activities, as well as first level data analysis.

Identification and scoping of SSCs to be inspected are covered under the Life Cycle Management Plan (LCMP) activity, supported by BP-PROC-00400, Life Cycle Management for Critical SSCs, and/or its associated procedures. Non-destructive examinations of pressure boundary components are initiated from BP-PROG-10.02 [86] and BP PROG 00.04. The assessment of inspection data is covered under BP-PROC-00383.

BP-PROC-00400 [49], Life Cycle Management for Critical SSCs, supports the Equipment Reliability Program (BP-PROG-11.01) and enables the development of LCMPs for SSCs. The procedure states that it is consistent with RD-334, “Aging Management for Nuclear Power Plants”, and the Institute of Nuclear Power Operations (INPO) AP-913, Equipment Reliability [87].

The LCMP pulls relevant technical information (e.g., age related degradation mechanisms, replacement and major overhaul tasks/frequencies, current condition) from the Condition Assessment Report(s), Technical Basis Assessment(s) (TBA), Performance Monitoring Plan(s) (PMP), Health Report(s), and use this information to document the recommended long term mitigation options for the subject SSC. These recommended options are included in the Asset Life Projections & Options (ALPO) documents. Table 5 shows the classes of equipment covered in confidential reports to date.

Table 5: Equipment Classes Addressed in ALPO Studies To-Date

System or Component	System or Component
Motors, Pumps and Compressors	Primary Heat Transport (PHT) Feeders
Pressure Vessels and Tanks	Negative Pressure Containment System Components
Heat Exchangers	Fuel Route
Buried Piping	Turbines and Auxiliaries
Nuclear Piping	Main Generators and Auxiliaries
Secondary Piping	Electrical Systems
Above Ground Service Water Piping	Electrical Cables
Valves	Instrumentation and Control (I and C)
Critical Manual Valves	Computer Systems
Calandria and Shield Tank Assembly (CSTA)	Common Services
Steam Generators and Preheaters	

The ALPO process, outlined in a process chart in Section 4 of BP-PROC-00400 [49], adds key information needed in business strategy decisions to the recommended long term options. Once the business strategy decisions are made the approved mitigation options (long term plan) are documented in the LCMP, and the LCMP is issued. BP-PROC-00400 is also relevant to "Safety Factor 4: Ageing". Reference [88] provides insight into the rigour of the review to which the End of Life (EOL) projections were subjected.

BP-PROC-00457 [63], Development and Approval of Predefined, defines the process for developing and approving new Predefineds and defines management controls for changing Predefines.

BP-PROC-00498 [64], Condition Assessment of Generating Units in Support of Life Extension, takes guidance from CNSC RD-360. Its emphasis is on a review of safety and safety related SSCs and design basis, condition of the SSCs, and safety performance and equipment qualification. A CA reviews plant data to establish the physical conditions of SSCs and evaluates their functional capability and remaining service life at a plant level. Both the Safety and Licensing and CA analyses provide the basis for economic and feasibility decisions for Life Extension and for project scope development.

BP-PROC-00501 [65][10], Integrated Preventive Maintenance Program, establishes the Bruce Power policy defining the Preventive Maintenance (PM) Program objectives, organization and processes. It discusses the methodology to be used to effectively:

- Specify preventive maintenance activities; Achieve "Equipment Reliability" (ER) goals; and continuously improve Bruce Power site PM programs.

The program meets the PM standards for INPO AP-913 ER Process Description [87] elements that support Continuing ER Improvement; Scoping and Identification of Critical Components; Performance Monitoring; and Corrective Actions.

BP-PROC-00532 [62][11], Critical and Strategic Spares, enables the identification of Critical and Strategic Spares through the development of Critical Spare Assessments for components. This process supports BP-PROC-00779, Continuing Equipment Reliability Improvement. The CSA determines which components are essential to the primary function of the subject equipment, and documents recommended Critical Spare quantities. Critical Spares will ensure that components are available in the event of unexpected equipment failures.

BP-PROC-00533, Obsolescence Management [50], takes its authority from BP-PROG-11.01, Equipment Reliability [39]. It describes the proactive and reactive processes taken to ensure that equipment obsolescence vulnerabilities critical to equipment reliability and plant availability are identified, prioritized and resolved in short term, long term, and cycle management. This

[10] Previous Safety Factor reviews referenced Revision 003 while the current revision is Revision 005. A document compare revealed no substantive differences in intent. The migration from R003 to R005 tightened up some definitions and added cross-references to other PM procedures.

[11] Revision 2 of this procedure was a major rewrite from R001, which was reviewed in previous Safety Factor assessments. It is now focussed more on Asset Management, but the intent is still the same – to support BP-PROC-00779.

procedure provides an overview of the identifying, prioritizing and resolving obsolescence issues. It is also aligned with INPO AP-913 [87], among others such as Electric Power Research Institute (EPRI) TR1019161 [89] and Nuclear Utility Obsolescence Group (NUOG) NX-1037 [90][12].

BP-PROC-00534 [51], Technical Basis Assessment, enables the development of TBAs for component types. It is consistent with CNSC direction in RD-334, "Aging Management for Nuclear Power Plants", and the recommendations in INPO AP-913, Equipment Reliability Description [87]. The TBA provides a baseline for the maintenance strategy of the component type and documents this information using a maintenance template. To develop the maintenance template, a Failure Modes & Effects Analysis (FMEA) is produced. The FMEA lists the degradation mechanisms that cause or influence the failure modes of the component type. Mitigating tasks are identified, up to and including the complete replacement or major overhaul of the component type, and appropriate frequencies for these tasks are populated in the maintenance template.

As of mid-September 2014, there were numerous TBAs listed in PassPort, focused on generic equipment categories such as valves, piping, tanks (including calandria), heat exchangers, and handswitches over the period from end of October 2013 to end of August 2014.

The preventive maintenance template, BP-PROC-00789, Preventative Maintenance Template Control and Revision [91], serves as the baseline for the development and analysis of specific maintenance tasks (e.g., PMs). It is not meant to capture all of the specific condition-based factors that may affect the component type. Additional analysis must occur before applying the maintenance template to specific equipment tags (Maintenance Strategy, as per BP-PROC-00789 Section 4.4). Tasks relating to the end of life of a component, such as replacement or major overhaul, have a recommended implementation plan developed for them in the LCMP process (LCM for Critical SSCs, as per BP-PROC-00400).

BP-PROC-00582, Engineering Fundamentals [46], is crucial in setting expectations for Engineering staff and enumerates fundamental tasks expected as part of every-day job activities. Based on an INPO recommendation, the fundamentals are defined as the essential knowledge, skills, behaviors, and practices personnel need to apply to conduct their work properly. It assists with establishing basic nuclear safety culture among engineering staff. It emphasizes activities that support plant condition and condition assessment.

Appendix A of BP-PROC-00582 lists governing principles for engineers and their managers. The following selected quote extracted from the first of the fourteen categories demonstrates expectations that directly support condition assessment review tasks.

[12] Distributed by INPO. Nuclear Utility Obsolescence Group (NUOG) composed of representatives from nuclear utilities, industry organizations (e.g., INPO, EPRI), and selected suppliers.

Table 6: Bruce Power Expectations for Engineers, BP-PROC-00582

Category	Engineers' Behaviour
Monitor and Evaluate	• Know your equipment. Complete rigorous daily monitoring and ensure aggregate risk is considered for degraded and/or out of service equipment. • Use routine walk downs and interactions with Operations and Maintenance to become familiar with system and component challenges. • Complete and document walk downs as detailed in the performance monitoring plan. • Understand design and operating margin, use established processes to identify and communicate any reduction in margins, including conditional Single Point Vulnerabilities. • Engage operations, maintenance and other stakeholders when assessing system/component/program health and their associated improvement plans. Use the Station Plant Health Committee to identify health threats and solutions. • Proactively identify degraded equipment conditions or repetitive equipment issues through performance monitoring activities and trend analysis. Proactively monitor for and take action on any adverse performance trends. Use the SCR process to document adverse conditions and the Corrective Action • Process to document actions to prevent recurrence. • Monitor for and expect material condition excellence. Use the established work management processes to achieve material condition excellence. • Optimize use of Predictive Maintenance techniques to monitor system and component performance.

BP-PROC-00666 [52], Component Categorization, provides the basis for categorizing components at Bruce Power. Consistent and accurate categorization of components supports BP-PROC-00694 [84], Maintenance Procedure Development and Revision, establishes the requirements for initiation, development, review, verification, approval, and validation of Maintenance Procedures used to perform maintenance on a facility SSC. It replaces SEC-MSS-00004, Proactive Maintenance Process [92].

BP-PROC-00778 [53], Scoping and Identification of Critical SSCs, and is fundamental to the successful execution of BP-PROG-11.01, Equipment Reliability Program. It is consistent with the recommendations in INPO AP-913, Equipment Reliability [87]. It describes the process for identifying SSCs important to maintaining safe, reliable power operation. Aspects of nuclear safety (reactor safety, industrial safety, environmental safety and radiation safety) are addressed.

The procedure provides the basis for developing system and component performance monitoring plans (SPMPs and CPMPs) and PM strategies, or redesign requirements.

Specific objectives of this procedure are:

- Categorize the criticality of the component (Critical Category 1 to 4) based on the functional failure effect of the component and value of preventive maintenance;
- Provide the criteria to identify Single Point Vulnerabilities; and
- Populate other component data in PassPort Panel D041 in support of component maintenance strategy development. The data include duty cycle, service condition, and S-98 equipment importance designation.

BP-PROC-00778 [53] further identifies:

- Scoping criteria;
- Functions of SSCs related to safety and reliability;
- Critical structures and components that support these functions;
- Non-critical components; and
- Run to failure components (Category 4).

Systems important to maintaining safe, reliable power operation include those identified in the safety related system list (BP-PROC-00169 [93]). Systems important to maintaining safe, reliable power operation include those identified as systems important to safety (DPT-RS-00012 [94]). Components important to maintaining safe, reliable power operation include components on the master equipment list (MEL) identified as critical or significant to plant operation. This includes:

- Components important to safety in systems important to safety; and
- Components that are single points of vulnerability.

Components and structures not on the MEL (such as piping, cables and supports) are reviewed to identify those important to maintaining safe, reliable power operation. SSCs are prioritized to optimize safety, reliability, availability, cost and performance within the regulatory framework.

BP-PROC-00779 [54], Continuing Equipment Reliability Improvement, describes the process for development and optimization of the preventive maintenance technical basis and tasks to support a documented Preventive Maintenance program, for the SSCs identified in BP-PROC-00778, Scoping and Identification of Critical SSCs.

Industry templates are available for major component types, and identify failure mechanisms, monitoring and mitigating tasks and task frequencies, based on external OPEX. Selected templates are configured for Bruce Power application through a TBA (BP-PROC-00534, Ageing and Obsolescence Technical Basis Assessment) using internal and external OPEX, to create a Bruce Power PM Template. The Bruce Power PM Template identifies planned, periodic, and predictive tasks and frequencies, on a structure or component basis for Category 1, 2 or 3 components. The TBA is conducted to support development of the PM templates.

The TBA identifies failure and degradation mechanisms, monitoring and mitigation tasks for those mechanisms. The TBA provides a technical basis for the maintenance strategy for this equipment, as implemented by the templates.

BP-PROC-00780 [55], Preventive Maintenance Implementation, describes the process for performing preventive maintenance to continuously improve the equipment reliability process. It outlines the interface with the work management system to schedule periodic, predictive and planned maintenance for SSCs on a prioritized/risk informed basis. It describes the development and use of model work orders to perform preventive maintenance, and the development and use of a standard set of post maintenance tests to verify important SSC functions and the effectiveness of the maintenance performed.

Preventive maintenance covered by this procedure includes periodic, predictive and planned maintenance. It covers preventive maintenance performed during operation and during outages. Preventive maintenance includes tasks scheduled for components on the MEL (e.g., pumps, motors, tanks) and inspection programs carried out for components not on the MEL (e.g., piping, building structures, feeders).

Documenting the equipment as found condition is important to a continuously improving equipment reliability process, and BP-PROC-00780 presents the process for capturing information from maintenance personnel on the as-found condition and providing feedback to the Responsible System Engineer (RSE) /Station Component Engineer.

BP-PROC-00781 [56], Performance Monitoring, provides the basis and expectations for the Equipment Performance Monitoring Process and supports the ER Program (BP-PROG-11.01).

The scope of the SSCs included in the performance and condition monitoring program is identified by assessing the criticality of the SSC. This is done by applying the appropriate screening criteria to the function of the SSC and assessing the impact of SSC failure on plant safety, reliability or economics via BP-PROC-00778, Scoping & Identification of Critical SSCs.

The procedure describes the process for establishing performance criteria and monitoring parameters for important structures, important system functions and critical components and program performance. This procedure describes the:

- Monitoring and trending of system performance;
- Monitoring and trending of component performance;
- Monitoring and trending of program performance;
- Trending of PdM results;
- Use of operator rounds monitoring;
- Monitoring of SST results; and
- Monitoring by RSE/Station Component Engineers walkdowns.

Performance monitoring results are recorded in System Health Reports (SHRs), Component Health Reports (CHRs) or Program Health Reports (see BP-PROC-00863 below). The development and implementation of long term equipment health plans is documented.

BP-PROC-00782 [57], Equipment Reliability Problem Identification & Resolution, describes the problem resolution process, including the interface with the SCR process (BP-PROC-00060) and the Action Tracking Process (BP-PROC-00019). It describes the process to follow when a critical SSC experiences an unplanned failure or when performance is seen, through Performance Monitoring, to have degraded. This element of the ER process corresponds to the Corrective Action component of INPO AP-913 [87]. Required Corrective Maintenance is executed according to the procedures in BP-PROG-11.04, Plant Maintenance Program.

For an unplanned critical SSC failure, the relevance to nuclear safety is assessed and either an equipment apparent cause or root cause investigation of the degradation or failure is initiated in accordance with BP-PROC-00060, SCR Process [Corrective Action Program] [95]. Corrective actions are determined, including providing feedback to the Continuing ER Improvement process.

As part of the resolution process, feedback is provided to developing and implementing long term system or component health improvement plans as part of the Performance Monitoring process. Periodic assessments are made of system, component and program health and vulnerabilities in Health Reports. The system or component health improvement plans are a forward looking assessment of current problems and future vulnerabilities, providing direction on system or component performance improvement.

BP-PROC-00783 [58], Long Term Planning & Life Cycle Management, enables the development of LCMPs and the identification and management of obsolescence issues. LCMPs are an input to asset management, and are used as feedback to drive the Continuous ER Improvement process (BP-PROC-00779).

Asset management as driven by the ALPO report series, Table 5, facilitates business decisions about capital and Operations & Maintenance investments, long term planning and asset replacement, and maintenance plans and priorities. This drives the following processes:

- Strategic and long range planning;
- Generation planning;
- Project evaluation and ranking;
- Budgeting;
- Plant/Front Line Engineering Emergent (Issues) Team valuation; and
- Ageing management.

BP-PROC-00825, Buried Piping Inspection Program [70], establishes the process and specifies the requirements to detect and assess degradation in buried piping as a result of its ageing and material degradation due to the effects of related degradation mechanisms, and to initiate corrective action at Bruce Power. These activities are performed to maintain buried piping integrity in order to reduce the risk of the potential impacts to the environment and public confidence in case if unanticipated buried piping failures occur, and to ensure that buried piping systems important to the safe operation of the plant are capable of meeting their design basis requirements until the projected end of life of the generating units/stations.

BP-PROC-00849 [71], Aggregate Risk Assessment and Monitoring, describes a methodology for Engineering staff to assess aggregate risk due to degraded equipment or off normal plant conditions. It helps build a culture where Engineering systematically conducts assessments of system equipment health as a periodic formal review. This aids Station Management and personnel in being aware of the overall risk to operations based on an assessment of the interaction of various risk contributors that impact a system or systems' reliability, and the subsequent potential for adverse effects on the overall reliability of the Station.

BP-PROC-00863 [72], Engineering Programs Health Reporting, provides the basis and expectations related to the development and generation of Program Health Reports to meet ER goals and continuous improvement. Health Reports are developed for those Engineering Programs that are deemed critical to ensure safe and reliable plant operation.

Engineering Programs are defined as an administratively controlled and ongoing engineering activity that implements regulatory requirements, World Association of Nuclear Operators (WANO) recommendations, plant efficiency and safety improvements, industry OPEX, or management requirements that are non-component specific.

Program Health Reports measure the health of Engineering Program scoping, planning and execution using defined criteria and metrics. The procedure supports BP-PROC-00781, Performance and Condition Monitoring. BP-PROC-00781 in turn supports BP-PROG-11.01, ER and implementation of the INPO AP-913 ER Process [87].

DPT-PE-00008 [76], System and Component Performance Monitoring Plans, provides the basis and expectations for the development, generation and implementation of SPMPs and CPMPs that engineering continually monitors risk significant systems & component groups.

It directly supports execution of:

- BP-PROC-00781, Performance Monitoring;
- DPT-PE-00009, System and Component Performance Monitoring Walkdowns;
- DPT-PE-00010, System Health Reporting; and
- DPT-PE-00011, Component Health Reporting.

PMPs contain detailed requirements for System/Component Engineers to use in performance monitoring of their assigned equipment. These requirements include [76]:

- Performance goals;
- Functional failure modes; and
- Identification of equipment (performance monitoring equipment list) and performance indicators to be trended.

DPT-PE-00009 [77], System and Component Performance Monitoring Walkdowns, provides the basis and expectations for the execution of system and component performance monitoring walkdowns. It provides guidance to Plant Engineers for conducting walkdowns on the applicable systems and component types as described in BP-PROC-00382, Performance and Condition Monitoring.

Walkdowns are intended to allow Plant Engineers to assess System and Component health and material condition. A strong walkdown program supports high standards for identifying and evaluating degrading material and operating conditions consistent with the INPO Critical Success Factors for ER.

DPT-PE-00010 [78], System Health Reporting, provides the basis and expectations related to the development and generation of SHRs to meet ER goals and continuous improvement. SHRs are developed for those systems and associated equipment that are deemed critical to ensure safe and reliable plant operation.

The procedure defines the scope and content of SHRs by:

- Providing directions for compiling and evaluating specific system information to determine a graded system health status (e.g., operating status, performance monitoring results and trending, ageing and obsolescence issues, reliability concerns);
- Assessing system "critical" equipment condition by measuring System Performance Monitoring Plan, Performance Indicators against a predefined set of criteria;
- Providing for trending of System Health and Performance Indicators over time to discern the direction of System performance and proactively identifies changes needed to improve equipment reliability and system health; and
- Defining the Health Report document and communication requirements to capture and convey the graded system health and identified issues/action plans to Plant Management.

DPT-PE-00011 [79], Component Health Reporting, provides the basis and expectations related to the development and generation of CHRs to meet ER goals and continuous improvement. Health Reports are developed for those Components that are deemed critical to ensure safe and reliable plant operation.

It defines the scope and content of CHRs including:

- Providing directions for compiling and evaluating specific Component information such as operating status, performance monitoring results, ageing & obsolescence issues, reliability concerns, to determine a graded Component health status;
- Assessing Component condition by measuring the CPMP Performance Indicators against a predefined set of criteria;
- Providing for trending of Component health and Performance Indicators over time to discern the direction of Component performance and proactively identify changes needed to improve equipment reliability and Component health; and
- Defining the Health Report document and communication requirements to capture and convey the graded Component health and identified issues/action plans to Plant Management.

BP-PROC-00893 [73], Fuel and Fuel Channel Program, identifies and addresses multidisciplinary parameters to assure safe and reliable operation of Fuel and Fuel Channels. It takes authority from BP-PROC-00781, Performance Monitoring and is part of the ER Integration.

Bruce Power Procedures define how work is performed. A procedure falls below the Program level in the document hierarchy and consists of a structured set of activities designed to produce an output or it may be an informational document that establishes a standard, expectation or other requirement. Standardization of procedures/processes is required across Bruce Power.

In addition to general procedures, section procedures based on the application of NuSCI covers a technical process to facilitate the creation of operating, maintenance and engineering type procedures at the equipment and component level. Similar to the EQ program and processes these other equipment qualification aspects have been previously reviewed within Safety Factor 3 on equipment qualification [94] Appendix 3 and [11]). These procedures ensure the condition of components in multiple systems such as motors, valves and heat exchangers (HXs) are monitored, reviewed and managed in a common manner. Examples include:[13]

- SEC-RE-00017 [82], Motor Program;
- SEC-ME-00008 [80], Heat Exchangers; and
- SEC-ME-00010 [81], Inspection and Monitoring Once-Through Service Water Systems.

4.7. Chemistry Management Program, BP-PROG-12.02

BP-PROG-12.02 [43], Chemistry Management, defines the fundamental business need, constituent elements, functional requirements, implementing approaches and key responsibilities associated with the management of plant chemistry. Its objective is to establish the optimum conditions for system chemistry and to mitigate conditions that could lead to an adverse effect on nuclear safety, radiological safety, personnel safety, environmental safety or plant condition. The requirements of this program meet the requirements of CSA N286.5-95 for Chemistry Control, Section 7.0. BP-PROG-12.02 is also relevant to “Safety Factor 4: Ageing”.

Optimum chemistry control is maintained during plant states, including start up, operation, shut down and lay up to minimize material degradation, radiation fields and optimize plant

[13] Previously [2], this list included SEC-MSS-00004 [92], Proactive Maintenance Process, and SEC-ME-00007 [74], Pipe Wall Thinning – FAC. The requirements in these two procedures have been promoted to the BP-PROC series. SEC-MSS-00004 has been superseded by BP-PROC-00694 R007 and SEC-ME-00007 by BP-PROC-00923 R000. For SEC-ME-00007, a comparison of the two documents reveals large blocks of common text. That is, BP-PROC-000923 appears to be an upgrade of SEC-ME-00007 R003. However, the update does codify the Periodic and In-service Inspection programs as being a continuing requirement of Section 4.3 of the PROL. The new PROC is considerably more prescriptive in terms of consideration of Engineering Analysis and Documentation (BP-PROC-00166 / DIV-ENG-00005), on the requirement for FASAs, on training and qualifications of inspection staff, and on review, classification and acceptance of the inspection results. This PROC will require an update to N286-12 when the time comes. OPEX plays a role in selection of components for inspection.

performance and life. Chemistry control is conducted to achieve high standards in the control of plant chemistry, establishing the optimum conditions for system chemistry and mitigating conditions that could lead to an adverse effect on nuclear safety, radiological safety, personnel safety or the environment.

4.8. Fuel Management Program, BP-PROG-12.03

BP-PROG-12.03 [44], Fuel Management, defines the fundamental business needs, constituent elements, functional requirements, implementing approaches and key responsibilities associated with all aspects of fuel management. Its objectives are to: (a) Optimize reactor core operation within operating and regulatory limits; (b) Operate the reactor with fuel of an approved design, manufactured to strict quality assurance requirements; (c) Prevent fuel damage throughout the fuel life cycle and ensure removal of failed fuel from the core; (d) Achieve as low as reasonably achievable radiation exposure with fuel and Cobalt 60 activities; (e) Fulfill obligations under Canada's Safeguards Agreement; (f) Support fuel and fuel channel inspection; (g) Implement processes and procedures for activities required for the safe and reliable use of nuclear fuel. The condition of fuel is reported annually to the CNSC per Section 3.8 of [142].

5. Results of the Review

The results of the review of this Safety Factor are documented below under headings that correspond to the thirteen review tasks as listed in Section 1.2 of this document. First, an amplified discussion of SSCs important to safety (SIS) sets the context (Section 4 of this report introduces the topic). With the insertion of the SIS discussion, the subsection numbering corresponds to the list of review tasks, offset by one.

5.1. SSCs Important to Safety and their Classification

To focus the review of the condition of SSCs important to safety as part of this ISR, the initial step was to determine the SSCs that needed to be assessed from a nuclear safety perspective and eliminate those on the CA lists due to their relevance to only operational significance (e.g., the Main Generator).

The previous Safety Factor 2 review [11] for Units 3&4 utilized a screening and grouping of equipment and components for CAs based on a review of the entire SSC identification list (formerly called the Universal Subject Index; now called the NuSCI) [96]. This index includes both safety and non-safety related equipment and components, and subject disciplines (e.g., Regulatory correspondence (00531)). This screening and grouping was used to determine which SSCs needed to have CAs (CA Summary Report [97] [14] and [98]) as fewer CAs existed and the process and procedures to determine the appropriate systems were in their infancy. In the 6 or 7 years since that time, the process and procedures to determine which SSCs require CAs has significantly evolved. BP-PROC-00781 Appendix B, identifies the increased number of systems where CAs have been performed based on their importance to safety, importance to generation and asset preservation, and general significance (rotating equipment, valves, Instrumentation and Control (I&C) general, or based on engineering programs) for all of Bruce 014 and 058. Before the migration of producing CARs in favour of System Health Reports[15], there were approximately 200 CARs encompassing more than 200 systems, auxiliary systems, subsystems and components as CARs tended to include groups of NuSCIs. CARs provide a baseline and are referenced in the formulation of ALPO and asset management option sheets (AMOTs), precursors to LCMPs (see Section 5.2).

This complete list of CARs was compared to the probabilistic risk assessment [99] systems important to safety which complies with Regulatory Document S-98, plus the SOE priority 1 and 2 systems list ([100] Table 1, also reproduced as Table 6 in Section 5.3 below). These SSCs have been reflected in the Equipment Reliability Program [39]. Items were added (NuSCI 24100, 24400, 24500 and 34400) per Section 1.2, due in part to the events in Fukushima. These systems' lists compare favourably with the systems identified in the Risk Significant Systems list [94] for decision making purposes and the Safety Related System List, BP-PROC-00169 [93] which was used in the previous assessment and discussed in the CA Summary Report [97] (see footnote 14, page 34). The SHR listing of Appendix D provides the reduced review list from an importance to safety perspective.

Items relevant to production and operability (e.g., Main Generator), were excluded for the CA assessment for the interim PSR, and items that would not be expected to degrade during the next 10-year period were not reviewed (e.g., concrete, large vessels).

This Safety Factor Report uses the following explanation multiple times throughout Section 5, so it is appropriate to mention it at this stage to avoid repetition. A detailed review and status [101] for the SSCs important to safety[16] was conducted in late 2013 and it shows overall good to excellent performance for systems and components, trending upwards, as Bruce Power continues to focus on improving equipment reliability to achieve safe, reliable, and economic production. The assessment systematically reviewed and calculated numerical performance

[14] The interim PSR report [2] referred to the initial U34 refurbishment document [97] for guidance on how various review tasks could be addressed in response to the IAEA guidelines. These concepts are now included in improved quarterly SHRs, the key enhanced input for the review. Repeat references to the initial refurbishment assessment report throughout Section 5 should be interpreted in this context; i.e., when Reference [97] is invoked, it should be understood that information on system condition in the SHRs is also being invoked.

[15] Bruce Power stopped producing CARs in early April 2012. There was significant overlap among the various health reports, CARs, SHRs, and SPMPs, all with a slightly different format, purpose, and official records status. Bruce Power is in the process of rationalizing these reports.

[16] The review also included Tier 2 systems [56] supporting production, so it is more comprehensive than required for the present assessment.

indicators, augmented by day-to-day detailed assessments from RSEs and Responsible Component Engineer (RCEs). The report provides summary histograms of the performance indicators for Bruce A showing steady progress to 2012. It reviews the measures to improve performance and programs to bring systems and components requiring improvement to satisfactory or excellent ratings and concludes they are effective. Also, it reviewed the plans in place to improve the systems and components within the next licensing period to ensure that those systems and components receive effective support. A review of the only “Red” system (Instrument and Service Air) from last year’s review shows continued improvement to Yellow as new equipment is being phased in. Based on the continued emphasis on equipment reliability and monitoring and the aforementioned upward trend, it is a reasonable extension that no cliff edge deterioration in system reliability will have occurred, and thus the 2012 assessment continues to be valid in the one year time frame since last years’ review.

Bruce Power continues to determine the condition of SSCs by classifying them based on their importance to various parameters (e.g., operability, safety, single point vulnerability) and conducting regular reviews in the form of System Health Reports and Life Cycle Management Assessments.

5.2. Existing or Anticipated Ageing Processes

This section addresses review task 1. As noted previously, this review task overlaps extensively with Safety Factor 4, which programmatically would satisfy a significant part of this review task.

LCM is the integration of ageing management and economic planning adopted by Bruce Power to optimize the operation, maintenance, and service life of SSCs, maintain an acceptable level of safety and performance, and maximize return of investment over the service life of the plant (INPO AP-913 [87]). The Bruce Power LCMPs compile technical information from the Condition Assessments, Technical Basis Assessments, Preventive Maintenance Plans (PMPs), SHRs, and other data sources such as SCRs, Technical Operability Evaluations and Engineering Evaluations and use this information to document the recommended long term mitigation options for the subject SSC [2]. A key item from this compilation is an understanding of the age-related degradation mechanisms for the SSCs. These age-related degradations are used as inputs to the ALPO documents.

The LCMP mandate and organization are described in sheet 2 of BPMS. Two relevant roles for Engineering managers from that mandate that provide the essence of the structured process are:

- Manage the process to select and approve Asset Management options to achieve a resource leveled, integrated Asset Management Plan that will provide safe, reliable long term operation in alignment with corporate strategic and business planning objectives; and
- Monitor the quality of ALPOs, LCMP development and implementation, outage preparation and execution, MCR preparations, Project Management and Construction (PMC) execution, analysis and online inspections and maintenance as they pertain to execution of the Asset Management Plan.

LCMP Procedure Section 4.3 [49] requires Data Gathering and Review to focus on obtaining information externally from available industry sources and internally from Bruce Power sources on the SSCs in the area of potential failures, repairs/corrective strategies, ageing degradation, failure modes, and obsolescence. Lower tier Section procedures have been developed to assist the RSEs in particular disciplines to better understand and address the gamut of degradation mechanisms. For example, Inspection and Monitoring of Once-Through Service Water Systems discusses flow-related, biological and infrequent mechanisms to be considered when looking at more than 15 service water related systems at Bruce A and B (e.g., [81] Appendices C and D).

Appendix B of the LCMP procedure [49] identifies forty[17] existing and proposed plans. Each LCMP reviews existing failure modes and ageing processes to better understand the remaining service life of the SSCs and to determine what steps are required for their replacement, and when.

Part of the implementation of the LCMP involves the preparation of an AMOT [102] to assist with the decision for the best available option. Presently, about 400 AMOTs have been initiated with more than 90% of them worked down. These are presented to an AMOT committee composed of senior Bruce Power Vice Presidents and their support staff, and advice from the Station Plant Health Committee (SPHC). The successful option becomes part of the LCMP.

Therefore, Bruce Power meets the requirements of this review task.

5.3. Operational Limits and Conditions

This section addresses review task 2, and demonstrates that the reactor has Operational Limits and Conditions appropriate for systems important to safety to ensure safe operation. Sections 5.6 to 5.8 describe measures to demonstrate compliance with these limits.

Condition 1.1 of the PROL [15] requires that operation of the plant shall conform with the licensing basis (and hence the safety analyses (Safety Report)), and so the underlying assumptions become a key element of the essential requirements for safe plant operation. The limits and conditions associated with these essential safety requirements form the SOE are addressed in this section.

The requirement for design, analysis, operation and maintenance within the SOE is a fundamental requirement in the CSA standard N286-05, Section 6.3, Safe Operating Envelope (SOE) to which Bruce Power is currently licensed. The same requirement is included in Section 7.9.1 of CSA N286-12, expected to be invoked in the next licence.

The CANDU Owners Group (COG) document “Principles and Guidelines for SOE” [103], expands on these requirements and provides guidelines for implementation. These guidelines had a pseudo-licensing status during the development of the SOE Program at Bruce given that Bruce Power had committed to the CNSC to have a program that is consistent with this COG document. This COG document has been superseded by CSA standard N290.15-10 [23],

[17] A few additional plans have been identified in the interim since BP-PROC-00400 Revision 002 was issued. Detailed Tables 7 and 8 of Safety Factor 4 identify 36 issued, and additional 19 planned including component-generic LCMPs.

Requirements for the Safe Operating Envelope of Nuclear Power Plants. The requirement for operation within a well-documented SOE is also imbedded in Section 3.1 of the LCH for Bruce A [16]. In Section 3.1, the licence requirement to operate within a defined set of Operating Policies and Principles is met through compliance with CSA N290.15 and therefore is not addressed further here (see Safety Factor 5).

In a process similar to all Canadian CANDU utilities, Bruce Power implements the requirement by first extracting the limits from existing licensing analysis to an Operational Safety Requirements (OSR) document for each safety related system (DPT-NSAS-00012 [100]), and applies instrument uncertainty values to establish the limits of the envelope in operating space[18]. To ensure station compliance, the Reactor Safety Support Department performs a gap assessment [104] against operating procedures and confirms with stakeholders, such as design and performance engineering to ensure that the OSR limits with indication uncertainty bound the operating envelope. The process is complete for all Priority 1 and 2 systems for Bruce A (Table 6). There is an ongoing review and revision for sustainability in a managed process introduced during the refurbishment of Units 1 and 2.

The gap assessment also includes a review of the limits in the Impairments Manual (IM) used by Operations. The IM provides direction to Operations staff on what actions must be taken in what time frames if, during regular surveillance, a safety-related system is found to be operating outside the conservative values included in the IM. The time frame for action depends on whether the system would be able to meet its full or partial safety function. The loss of full function (e.g., no redundancy) demands prompt action, whereas systems with sufficient redundancy can be repaired in an orderly manner, although still within defined time frames.

Compliance with the SOE is continuously confirmed by a comprehensive set of operator and maintenance actions such as calibration of measuring equipment and tracking results, provision of alarms (visual, electronic, or digital), routine mandatory functional testing, formal panel checks, and operator field surveillances, see Sections 5.7 and 5.8.

These actions are performed at defined intervals consistent with the past performance of the system to meet reliability targets.

Table 6: SOE Systems

Priority	Bruce A System
1a	SDS1
	SDS2
	ECI
	Containment
	Fuel and Reactor Physics

[18] Instrument Uncertainty Calculations (IUC) result in a formal Controlled Document NK21-CALC series report; generally one IUC report for each SOE system.

Priority	Bruce A System
1b	Heat Transport System
	Moderator System
	Shutdown Cooling and Maintenance Cooling Systems
	Main Steam Supply System
	Feedwater and Condensate System
	Emergency Boiler Cooling
	Service Water Systems
	Powerhouse Emergency Venting System
	Qualified Power Supply
	Electrical Systems
	Reactor Regulating System
2	Fuel Handling Systems
	Shield Cooling System
	Annulus Gas System
	Post Accident Monitoring
	Confinement

Table 6 includes only SOE systems from the SIS list, most of which are common to the S-98 SIS list, per [105]. For these systems, test acceptance criteria are defined explicitly to stay within the licensing safety analysis.

In addition, every system has operating limits provided in its Operating Manual. Most systems, and especially all SIS, have SSTs with limits for reporting and followup. The performance (availability) of all SIS systems is tracked and reported to the CNSC in the Annual Reliability Report [105]. Many systems have hard wired alarms or control-computer-generated alarms at specific values (limits); for each alarm there is a one or two page instruction (alarm response manual) on how the operator is expected to respond.

In addition to these surveillances, there are operator field routines, where operators check the condition of operating systems.

These surveillances, including for non-SOE systems, are specified in the suite of Operating documentation for each system. Section 4 of BP-PROG-12.01 sets operations' expectations and documentation requirements. BP-PROG-11.01, Equipment Reliability, provides the authority for monitoring. BP-PROC-00781, Performance and Condition Monitoring, which takes its authority from BP-PROG-11.01 defines the activity of Performance Monitoring as *"To regularly check on identified parameters, which measure equipment and process performance in order to control that performance within acceptable and specified limits. Methods of monitoring can include such activities as time based trending of parameter levels, simple parameter level checks against a pre-set limit, observational results of walk downs, review of* *plant information trends/data, operational, shift logs, …*". Appendix B of BP-PROC-00781 lists the importance of systems to be tested, with the S-98 SIS list as Tier 1. Implementing procedures DPT-PE-00008, -00009, -00010 and -00011 cover the range of components and systems to be tested, and the means by which the testing is to be performed.

In addition, Bruce A has implemented a pattern recognition scheme, SmartSignal™ that is designed to notify the operator when any of thousands of parameters is outside its expected range for any given plant state. See Sections 5.7 and 7.1.1.5 for more detail.

Bruce Power meets the requirement for a controlled set of Operating Limits and Conditions.

5.4. Current State of SSCs with Regard to Obsolescence

This section addresses review task 3.

Obsolescence is a fundamental element of the assessment and decisions made in the Asset Management process. It has received significant scrutiny since the introduction of Equipment Reliability and its companion, Asset Management.

Section 4.1.3.3 of the Condition Assessment Summary Report [97] (see footnote 14, page 34) shows that a review of obsolescence was accomplished through interviews with Subject Matter Experts (SMEs). RSE interviews were the starting point. These interviews were documented and included in the applicable CAR. In most cases, this led to follow-up interviews with RDEs or component specialists, maintenance, and operations personnel. The topics discussed included system health; functional failures; events; obsolescence issues and concerns; ageing processes and concerns; trends and walkdown experience; and inspection history. The CA Summary Report [97] indicated in Section 4.1.4.3 that obsolete equipment was identified mainly from input provided by SMEs, maintenance and operations personnel, review of maintenance records and, where available, the original manufacturer. Specific observations were included in each CAR where warranted to provide the basis for recommendations. While CARs are being migrated to SHRs, they are still being used and incorporated in the LCMPs.

In terms of monitoring, obsolescence is more pertinent to components, but it is a required input for both Component (DPT-PE-00011) and System (DPT-PE-00011) Health Reporting. Both procedures provide "directions for compiling and evaluating specific Component [System] information such as operating status, … aging & obsolescence issues, …, etc., to determine a graded Component [System] health status". Systems comprise an assembly of components and so in one way or another obsolescence of components is directly included in the performance calculation arriving at the System Health colour-coded index, Green, White, Yellow or Red.

BP-PROC-00533 [50], Obsolescence Management, defines the methodology for, and outputs from, obsolescence assessment. Section 4 describes the methodology with the summary of BP-PROC-00533. The output is stored in the Reports section of the commercial Proactive Obsolescence Management System (POMS) software package, and is accessible via the Bruce Power intranet. It includes a database with obsolescence evaluations of thousands of components, from which the most important obsolescent items can be obtained (e.g., Top 10 or Top 100 lists can be extracted). Components are classified by their importance and whether they are a Single Point of Vulnerability[19] (SPV); i.e., importance to safety and/or vulnerability (e.g., loss of redundancy) put the component in the highest vulnerability classification. Obsolescence Value Ranking (OVR)[20] is a weighted numerical index using such inputs as safety classification, spare parts availability, number of spares in stores, maintenance work order history, required lead time, and SPV.

As noted, obsolescence is a contributor to the SHRs. In turn, the SHRs were a significant contributor to the detailed review [101] summarizing the status for systems important to safety that showed overall good and upward trending performance, as described in Section 5.1.

For the refurbishment of Units 1 and 2, there was an extensive review of obsolescence for instrumentation and control components, which resulted in the replacement of the types of components listed in Table 7.

Table 7: Replacement of Obsolete I&C Components in Units 1 and 2

Component	Summary of Replacements
Chart Recorders	Replace all Leeds and Northrup Chart Recorders in Main Control Room and Control Equipment Room (CER) with new Yokogawa digital Video Recorders of same form, fit and function. • For Units 1 and 2, there were 14 recorders replaced in the Main Control Room and 3 in the CER (each unit). • For Unit 0 (Units 1 to 4 common services): There was 1 recorder replaced in the Main Control Room and 3 in the CER.
Controllers General	Replace obsolete Fischer and Porter (F&P) 53 Series analog single loop controllers with ABB Micro DCI digital single loop controllers. For Units 1 and 2, there was a total of 49 controllers per unit: • 23 in the MCR panels • 17 in the CER for liquid zone control • 8 in the CER for supporting systems • 1 field panel located controller for generator hydrogen temperature control.

[19] The SPV designation identifies critical components that due to a lack of redundancy are especially important to the nuclear power plant An SPV is an SSC whose failure results in a Reactor Trip, Turbine Trip or Derate of >10% (BP-PROC-00666).

[20] This score an indicator (not absolute). The outcome depends on the algorithm and on the fidelity of the available inputs. The Obsolescence Program Coordinator can edit this list to adjust the rankings based on engineering considerations not calculated by the algorithm.

Component	Summary of Replacements
Controllers HT Feed, Bleed & Relief Pressure and Inventory Control (P&IC),	For each unit: • Replace obsolete F&P controllers with Programmable Logic Control (PLC) systems. • Redesign solid mode pressure control (63336-PIC3) so that a single fuse failure cannot cause a loss of control. • Separate power supplies for 63336-PT3 & -PT4 so they are fed from different busses to eliminate single mode failure. • HT F&B pressure control consists of 25 F&P single loop controllers in the MCR and ~ 50 supporting modules in the CER.
Controllers Boiler Feed Control System	For each unit: • Consists of 10 Foxboro controllers in the MCR, 7 in the CER and ~ 81 supporting modules in the CER. • Replace obsolete controllers with a Triconex Tricon PLC system, to be located in the CER. • Replace analogue controllers with a dual-redundant HMI with 2 touch sensitive screens.
Pressure Transmitters (Pressure, Level and Flow Indications)	Replace 79 (U1) or 81 (U2) obsolete Fischer & Porter (F&P) or Foxboro transmitters with equivalent Rosemount transmitters. Typical affected systems[21] are • Liquid Injection Shutdown System (LISS) poison tank levels (7 transmitters). • Storage Transfer & Recovery Circuit (2 transmitters) • Boilers & Preheaters (2) • Main Moderator Circulation System (8 transmitters) • Purification, Resin Handling & Storage System (1) • Moderator Cover Gas System (1) • D2O Collection System (1) • Moderator Liquid Poison System (4)

[21] For complete list see Reference [144].

Component	Summary of Replacements
	• Liquid Zone Control (18) • End Shield (4) • Boiler Feedwater (20) • Main Steam (6)
Non-EQ Cable	All cable, where the requirement was changed to EQ cable, was replaced. Cabling for systems that were upgraded was replaced. Cabling that was not replaced was functionally tested during the commissioning of the associated systems.

The preceding discussion shows that Bruce Power has a system for identifying, predicting, and managing obsolescent components. Therefore, Bruce Power meets the requirements of this review task.

5.5. Implications of Changes to Design Requirements and Standards on Actual Condition of SSCs

This section addresses review task 4.

In addition to the regular enhancement of standards, advances in technology (e.g., computer codes, solid state instrumentation), OPEX on materials performance (e.g., hydrogen uptake in pressure tubes, or FAC impact on feeders), operations observations (e.g., acoustic vibrations, concrete cracking) or significant events (e.g., Fukushima) are typical of factors that can lead to changes in standards and hence design requirements, some more precipitously than others. Some are needed to enhance safety, some to enhance production, some both.

There are at least four mechanisms by which a station faced with changes in standards can adapt. They are: a) design changes and associated equipment changes, b) engineering or nuclear safety analysis refinements, c) requests for deviation from the standard (e.g., either grandfathering or code cases), and d) operating envelope changes (most often more restrictive, but not always). Bruce Power has a full array of procedures to accommodate changes, a strong safety analysis capability, and a developed Engineering Change Control process to ensure compliance with the standards. The design process is more fully described in the report for Safety Factor 1, Design; the analysis processes to maintain and enhance safety are described in the reports for Safety Factors 5 and 6.

BP-PROG-10.01, Plant Design Basis Management [38], Design leads to BP-PROC-00335, Design Management [45] (interfacing document) and BP-PROC-00363, Nuclear Safety Assessment [106]. The exchange between the two procedures is a fundamentally iterative process that provides assurance that the plant Design Basis, as described in design documentation, and the safety analysis, as described in the Safety Report, provide a mutually consistent basis for safe operation. This iterative process continues until a design solution has been reached that meets all safety requirements, including those that may evolve during the course of design.

In the case of grandfathering and as noted in [11], Bruce A has been evaluated at least three times against IAEA International Nuclear Safety Advisory Group (INSAG-8) [107]. INSAG-8 provides a common basis for judging the safety of NPPs built to earlier standards. This document was used in the Bruce 3 and 4 Restart assessment against modern codes and standards, in the Bruce 1 and 2 Systematic Review of Safety, and the Bruce 3 and 4 ISR [11]. It provides guidance on how this review should be conducted, but does not explicitly feature in the review itself. In each case, Bruce A was assessed to be adequate for continued operation. The age of these respective reviews is noted, but for each case, equipment, analysis, and operational enhancements provided additional assurance of safe operation.

Bruce Power maintains Engineering and active Research and Development programs to anticipate and accommodate evolutions in standards. Ageing is one area where changes in standards could impact safety and/or operation. Through active participation in COG, Bruce Power contributes to programs such as Pressure Tube Life, fracture toughness, channel diametral creep and elongation, cable ageing (Power and I&C), Fibre Reinforced Plastic (accommodates N291 standard for refurbishment and modifications), computer code development and validation, chemistry and materials, hydrogen in containment, and studies on instrument survivability following a Severe Accident. Bruce Power participates in the CSA and American Society of Mechanical Engineers (ASME) organizations where nuclear and pressure boundary standards are set and modified. The following table, extracted from [34] and reproduced from the Safety Factor 9 report, demonstrates the extent of topics covered in these multidisciplinary studies.

Table 8: COG Major R&D Programs, 2014/2015

Number	Title	Areas[22]	#WP[23]
COG 14-9105	Fuel Channels R&D Program, 2014/2015 Operational Plan	7	77
COG 14-9205	Safety and Licensing R&D Program 2014/2015 Operational Plan	15	92
COG 14-9405	Chemistry, Materials and Components R&D Program, 2014/2015 Operational Plan	8	82

[22] Project Areas, or Disciplines.

[23] Active Work Packages per 2014/2015 Plan.

Number	Title	Areas[22]	#WP[23]
COG 14-9505	Industry Standard Toolset Program, 2014/2015 Operational Plan	20[24]	72
COG 14-9305	Health, Safety & Environment R&D Program, 2014/2015 Operational Plan	10	43

In addition to the Programs listed in Table 8 above, for Fuel Channels there is a parallel Joint Project, COG JP 4452, Fuel Channel Life Management Program, Phase 2 that uses the results of the above research and focuses on the aspect of FC LCMP, which is one of the highest priority topics for LCMPs.

Through a balanced approach among Engineering, R&D, Analysis and Operations adaptability, Bruce Power adapts to changing standards to accommodate plant conditions. Therefore, Bruce Power meets the requirements of this review task.

5.6. Plant Programs that Support Ongoing Confidence in Condition of the SSCs

This section addresses review task 5.

The Ageing and Obsolescence Project (AOP) is an Equipment Reliability (ER) improvement initiative launched over the past few years to raise the Bruce A and B station equipment reliability and is a key component of Bruce Power's Business Plan. The AOP was fashioned based on an understanding of the Regulatory expectations (RD-334, Aging Management for Nuclear Power Plants) and (S-210, Maintenance Programmes for Nuclear Power Plants), and international guidance (INPO AP-913, Equipment Reliability Process Description Rev 3; NEI AP-940, Nuclear Asset Management Process Description and Guidelines; and the Nuclear Utility Obsolescence Group (NUOG) NX-1037, Obsolescence Program Guideline Rev 1).

The objective of the AOP project is to improve plant equipment reliability through the optimization of:

- Equipment Preventive Maintenance (PM);
- Available critical spares; and
- Short-term mitigation of high risk, low reliability components through enhanced maintenance while awaiting long-term corrective fixes (usually design changes).

Over the past 4 years [108] [109], as a station-wide program, AOP has completed:

- Critical[25] Category 1 (including Single Points of Vulnerability[26] (SPVs)), non-Fuel Handling component assessments for both stations;

[24] 18 codes divided into 4 major disciplines: a) Containment and Severe Accident, b) Thermal hydraulics, c) Physics, and d) Fuel and Fuel Channels.

- Previous Critical Category 0 (not yet classified) component assessments at both stations; and
- Assessments of 6 selected Fuel Handling systems at both stations.

These assessments included estimates of remaining life, verification of criticality, determination and rationale for repair/replace strategies, review of and improvement to preventive maintenance strategies, and determination of stocking quantities for critical spares.

The project concentrates on three fundamental deliverables, specifically [108] [109]:

- Update of the outstanding high safety and high generation importance, critical component PM strategies to reflect the recently developed and approved Bruce Power PM Templates. These updates are expected to ensure best practice PM strategies consistent across similar components in both stations, including a critical review of the PM frequency appropriate to the condition of those components.
- Field implementation of the documented high importance PM strategies. Field implementation of the recognized and approved best practice PM strategies.
- Enhancement of the PM strategies associated with high risk/low reliability, aged and obsolete SPVs awaiting permanent design fixes or other long term obsolescence corrective measures. Enhanced PM strategy implementation will limit the unplanned outage risk that each of these SPVs to the maximum extent possible.

The scope of the project includes:

- Development of Fuel Handling LCMPs for reactor area bridges plus completion of the outstanding Fuel Handling system critical component basis assessments to align these systems with Bruce Power's ER initiative;
- Provision of Critical Spares Assessments; and
- Acceptance of the AOP Critical Category 1 assessment documentation.

The deployment of the AOP program that incorporates elements of internationally recognized CA principles and attention to the associated remedial actions shows that Bruce Power meets the requirements of this review task.

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[25] Critical Component - Is a component whose function is essential to system operation and/or operability (CRIT CAT 1 & 2). Critical Components are listed on the Performance Monitoring Equipment List (PMEL) within the approved System Performance Monitoring Plan (SPMP) and Component Performance Monitoring Plan (CPMP) (DPT-PE-00008/-00009/-00010) and meet criteria specified in INPO AP-913. Cat 1 is the highest importance component and Cat 4 is the lowest (full definition Appendix D of BP-PROC-00584 [110])

[26] The SPV designation identifies critical components that due to a lack of redundancy are especially important to the nuclear power plant An SPV is an SSC whose failure results in a Reactor Trip, Turbine Trip or Derate of >10% (BP-PROC-00666 [52]).

5.7. Significant Findings from Tests of Functional Capability of SSCs

This section addresses review task 6.

As indicated in the preceding sections, the documentation reviewed as part of the CA effort included reports that document results of tests that demonstrate functional capability, such as Health Reports - Inspections and Testing Status ([78] Section 4.11).

A detailed review [101] summarizing the status for systems important to safety and production shows overall good and upward trending performance (see Section 5.1).

As well, Bruce A has a full range of functional and performance tests, referred to as SSTs, that demonstrate the continuing availability of SIS. The results of testing are compiled in both the SHRs and the Annual Reliability Report [105]. The statistics demonstrate that reliability targets are being met or identify systems needing remedial attention. From the latest Report:

> *"All systems important to safety met their predicted future unavailability target except the Standby Class III Power System. The system was over target due to corrections in the Standby Class III Power System unavailability model to reflect plant operations. Corrective actions to bring the predicted future unavailability back to within target are being managed through the Bruce Power Corrective Action Program.*
>
> *The Unit 1 and Unit 2 Qualified Power Supply (QPS), Emergency Coolant Injection System (ECIS), Shutdown System 2 (SDS2) and Emergency Heating, Ventilation and Air Conditioning (HVAC) system failed to meet their actual past unavailability target due to an event in which passive ventilation was blocked in three instrument rooms each in Units 1 and 2. The Unit 3 Shutdown Systems one and two failed to meet their actual past unavailability targets due to an incorrect calibration event on temperature transmitters that are used for Reactor Inner Zone Inlet Header (RIZIH)/Reactor Outer Zone Inlet Header (ROZIH) impairment temperature calculations."*

The root cause physical items have been corrected and an SCR has been produced to address the modelling deficiency in a managed process. The modelling is also being tracked under CNSC Action Item 1307-4320.

Operating staff perform the SSTs at a frequency consistent with the reliability target for the system. There are two categories of SSTs, static and dynamic. Static tests involve no change of state of the system, for example panel meter readings that are recorded, compared against expected ranges, and archived for access by such staff as Performance Engineering, or Reactor Safety Support staff for assessment. Operator field inspections (also an SST) and maintenance predefines (e.g., lubricant analysis) are two more examples of static testing. Dynamic SSTs involve the injection of a transient signal to an instrumentation loop, such that parts of the system change state (activate) and the value of the actuation setpoint or time of actuation can be determined either from panel readings or using a digital comparator such as the Safety System Monitoring Computer (SSMC). In many of the cases, the injected signal is generated by short circuiting the legs of a transmitter or using a signal generator (a variable potentiometer is also a signal generator). Careful analysis shows that in the case of the short circuited transmitter, the transmitter acts only as a variable current source, just as in the case of electrical signal generators. That is, the success of getting a numerical value for the setpoint from either method counts on the calibration of the source – in both static and dynamic SSTs, calibration of the circuit element plays a pivotal role. Calibration must be performed with a specified frequency and performance statistics must be tracked to support the instrument uncertainty calculations mentioned in Section 5.3.

There are usually two acceptance criteria for testing of any parameter, action levels and impairment levels. The action level is set such that an operator can intervene in a system with deteriorating health before the impairment level is reached and so an operating margin is available. The setpoints include a statistically calculated allowance for indication uncertainties (e.g., instrumentation loop or timing loop uncertainties), such that the indicated value leads to intervention before the actual process value becomes impaired.

For process systems, the monitoring can be more automated, with data collection for the SST performed using the DCCs (digital control computers), for example valve stroke timing, or running currents of pump motors, which are indicative of their health.

There is a natural extension of the collection of data and monitoring digital signals using computers and mathematical algorithms (such as pattern recognition) to continuously monitor and cross-correlate a large number plant variables to assess whether any parameter is trending outside its normal range for the present plant operating state. If detected, the computer can generate an alert to Operations staff to examine and correct the anomaly. Digital monitoring is a mature technology and has been deployed in nuclear plants world-wide with varying degrees of success for more than 25 years. Bruce has experimented with several schemes of this type over the years and is presently using a commercial product called SmartSignal™. Bruce B was fully implemented in the fall of 2012 and Bruce A was fully implemented by the end of 2013. Retraining the mathematical models for systems that have been refurbished at Bruce A will reduce the spurious alarms and improve operator confidence. (See FASA described in Section 7.1.1.5.)

If in the above processes, any critical parameter is found outside the allowable value, operators are required to take action to restore it to within safe operating limits. In the case of Special Safety Systems, the required actions are ultimately defined in the Safety Systems Impairment Manual [111], as described in Section 5.3. Limits and corresponding actions for systems not included in the Impairments Manual are included in other operating manuals, such as the System OM, Alarm Response Manuals (ARMs), or Operator Field Routines (usually driven by an SST).

Testing on all systems, impairments or not, are tracked by the RSE and reported in the equivalent SHRs (and previously in the CARs).

Any test evoking the Impairment Manual gets immediate followup attention from the RSE and shortly after from the Reactor Safety Engineering staff. The results of these investigations for SIS are incorporated in the system's actual unavailability reports and reported annually in the Reliability Report [105].

In summary, the results from SSTs, maintenance, routine call ups (predefines), calibration, operator observation, and field routines do provide a supportable and robust means of monitoring and trending the operability of systems and components to support the conclusion that Bruce Power programs meet the requirements of this review task.

5.8. Results of Inspections and/or Walkdowns of SSCs

This section addresses review task 7.

In addition to reviewing the results of routine inspections, Section 4.1.3.2, “Walkdowns”, of the CA Summary Report [97] (see footnote 14, page 34) revealed that a walkdown was conducted for each SSC group. Significant observations were recorded photographically for followup with the RSE and inclusion in the CAR. This process and the lessons learned were fed back and included in the revised CAR procedure [64]. This improved procedure was then used in the walkdowns of the Unit 058 units. The results are captured in the CAR reports identified in Appendix C.

Also, RSEs are required to record observations of walkdowns in the SHRs - Inspections and Testing Status and Field Walkdown Highlights ([81] Section 4.11.5), as required by DPT-PE-00009 [77], described in Section 4.

While Units 012 were inspected extensively as part of restart activities, operational status of Units 3 and 4 prevented a comprehensive walkdown in controlled access areas (e.g., reactor vault, boiler rooms) [97] (see footnote 14, page 34). However, for critical SSCs, opportunities do arise for RSEs to walk down their systems during outages recognizing system conditions and configuration do restrict some systems from being fully inspected (e.g., where insulation covers piping). In these situations, susceptibility reviews are employed to determine those areas most impacted by degradation mechanisms associated with pipe wall thinning (e.g., [81] Section 4.1) and corrosion. This improves program effectiveness by ensuring resources are focussed on key areas. As appropriate, non-destructive means are employed to assist the inspection data gathering for these hard to access areas. The non-destructive examination specialists provide the results to the RSEs so they can be captured in the SHRs and CARs (e.g., [81] Section 4.5.1 and Appendix D; [75][27] Sections 4.9.1.4 and 4.9.1.5).

Another special type of walkdown occurs while members of a dedicated group in Bruce Power conduct Periodic Inspections according to the plans required by CSA standards N285.4, N285.5 and N287.7. These inspections take place in diverse locations throughout the units. The inspectors have formal qualifications and provide a continuous set of snapshots of the status of components in the station. The components have specific acceptance criteria. The reports are approved by qualified inspectors and filed formally in their own sub-type category in Controlled Documents.

Other mechanisms to invoke walkdowns are commissioning (or recommissioning) of systems following maintenance or refurbishment such as provided by Units 1 and 2 refurbishment AFS activities and Unit 4 West Shift, or special requests for walkdowns from regulatory bodies, such as the CNSC or Bruce Power’s Authorized Inspection Agency (AIA, i.e., TSSA (Technical Standards and Safety Authority)). For example, there was an extensive series of walkdowns following the Fukushima event, and more recently, there was an extensive set of walkdowns with the CNSC to support Bruce Power’s S-294 submission (Attachments 5, 6, and 11 of [112]).

[27] This procedure supersedes the previous SEC-ME-00007. The revision does not require a walkdown, but counts on the provision of results of inspections through reports.

In addition to these considerations, Section 7 reviews a selection of Self Assessments and Internal/External Audits and Inspections, some of which are formal CNSC Inspections. Fukushima is one of the events discussed.

A detailed review [101] summarizing the status for systems important to safety and production shows overall good and upward trending performance (see Section 5.1).

Bruce Power programs meet the requirements of this review task.

5.9. Maintenance and Validity of Records

This section addresses review task 8.

Generically, Bruce Power maintains an extensive and comprehensive documentation system stored digitally with hard copy records in some cases. Procedural Controlled Documents are under continuous review and periodic revision as described in BP-PROC-00098. Table 9 illustrates some of the topics covered in companion procedures and the extent of attention to records.

Table 9: Sample of Records Procedures

Document #	Title	Rev #
BP-PROC-00068	Controlled Document Life Cycle Management	021
BP-PROC-00098	Records Management	014
BP-PROC-00238	Retention Process for Bruce Power Records	011
BP-PROC-00358	Software Records	005
BP-PROC-00454	Controlled Document/Record Type and Subtype Maintenance	004
SEC-DOCM-00023	Controlled Documents	023
SEC-DOCM-00029	Records Retention Authorizations and Destructions	009
SEC-DOCM-00030	Controlled Documents - Engineering Drawings	008
SEC-DOCM-00035	Records Retrieval and Secure Storage	014
SEC-DOCM-00042	Controlled Documents - Issue and Distribution of Flowsheets	006
SEC-DOCM-00053	Processing and Microfilming Records	007
SEC-DOCM-00056	Records Indexing	005

For items such as routine maintenance and monitoring records, and SSTs, Bruce Power maintains hard copies and digital copies of such documents as completed Control Maintenance Procedures (CMPs), Mechanical Maintenance Procedures (MMPs), SSTs, and Operator Field Inspections to name a few. The Operations and maintenance and I&C technicians return mark-ups of completed procedures to the main control room, where they receive an initial screening. They are then sent to a data centre on the 6th floor near the Performance Engineers (System Engineers) for immediate reference, electronic cataloguing (completion, success/failure) and eventual transmission in batches to the Bruce Power Records Department where they are scanned and filed in the vault. The electronic cataloguing allows functional groups, such as Reactor Safety Support, to review regularly scheduled testing and request a copy from Records of items of interest (e.g., failed SSTs).

Records have a retention period defined based on their importance to plant operation.

As noted in the previous section, formal Periodic Inspections, e.g., as required by N285 and N287 series standards, are recorded in the Controlled Document System in their own report series category (e.g., NK21-REP-IR-NuSCI-serial).

In addition to a formal Controlled Documentation system, Bruce Power (and before that OPG) has scanned and indexed much of the Bruce legacy design, correspondence, reports, procurement, commissioning, and operations information. This information is available for any authorized computer user in Bruce Power to search and analyze.

In the context of Condition Assessment and as described throughout this report, Bruce Power has embarked on a systematic process to examine, characterize, assess, and maintain or rejuvenate the equipment to meet the mutually consistent objectives of safe operation, assurance of stable production to meet commercial targets, and protection of the long term investment. Broadly speaking, this process is called Asset Management. Significant effort has been applied to formally record and trend the condition of systems important to safety in CARs, and SHRs, and to record measures in ALPO documents and to update and upgrade systems requiring attention in LCMPs.

The Maintenance Program Document BP-PROG-10.04 subscribes to the importance of record keeping:

> "*Records are kept to track equipment inspections, monitoring, repairs, failure information, including specific component, cause of failure and actions taken to correct, and equipment condition post repair. BP-PROC-00695 [Maintenance Program and Activities] describes this process and ties to other programs needed to maintain this element of the maintenance program.* "

BP-PROC-00695 provides a systematic approach towards identifying what maintenance activities are to be performed on given SSCs and at what frequency/intervals. It is written to align and satisfy the expectations set forth in CNSC S-210 (Maintenance Programs for Nuclear Power Plants).

BP-PROC-00694, Maintenance Procedure Development and Revision, establishes the requirements for initiation, development, review, verification, approval, and validation of Maintenance Procedures used to perform maintenance on a facility SSC.

The FASA in Section 7.1.1.6 is an example of one group's proactive efforts to have records suitable to the work located in a convenient and visible place (as well as in the Records system as per procedures).

Maintenance Records

As indicated in the preceding sections, and based on the procedure requirements in Section 4 and the documentation reviewed as part of the CA process, this review task requires consideration of maintenance records for Bruce 014 systems. This section provides two examples, of many, where specific programs define requirements for maintaining records:

- The Inspection, Monitoring and Maintenance Review (IMMR) on HXs describes the process for determining and documenting the existing degradation mechanisms, inspection methods, and maintenance and monitoring activities that assure design basis characteristics are met. The required document format and review and approval steps for IMMRs are described in B-STM-04660-10000, HX IMMR ([80] Section 4.6).
- The Motor Program [82] highlights the need to capture feedback from internal and external motor experience and implementing enhancements is critical for improving the Motor Program and equipment reliability. It defines the formal Preventive Maintenance (PM) feedback process that captures as-found equipment condition. It promotes a questioning attitude and identification of alternative strategies, improved testing and monitoring, and optimized PM tasks and frequencies based on station component operating and maintenance experience. PdM results reside in a computerized database Plant IQ. The trades staff enters the data and comments; the PdM program owner reviews that data and provides a report to the Responsible Component Engineer (RCE). The RCE then provides the engineering decision for the paths forward and, where useful, a benefit-cost analysis. The final report is issued to the affected RSE(s) for information and tracking ([82], Section 4.4.4).

As described in this section, Bruce Power has processes for recording formal documents (Controlled Document) and records of routine operation of the station such as maintenance and testing. Therefore, Bruce Power meets the requirements of this review task.

5.10. Evaluation of the Operating History of SSCs

This section addresses review task 9.

Section 4.1.3.1, “Review of Records”, of the CA Summary Report [97] (see footnote 14, Page 34) shows this was accomplished by reviewing Design and Operation documentation, Maintenance and Inspection records, Temporary and Permanent Configuration Changes and Operating Instructions, Performance Monitoring reports (Health Reports), available internal and external OPEX information including COG, WANO and the SCR databases, open and completed Technical Operability Evaluations (TOEs), the station risk log, Capital Plan, and Small Project Database for Units 034. A similar scope of work was completed during the Units 3 and 4 Restart in 2003, and was proposed or in progress when the Units 1 and 2 Refurbishment Project was also reviewed.

Similarly, Section 4.1.4.4, of the CA Summary Report [97] (see footnote 14 Page 34), “Compliance with Design Requirements and Basis”, revealed the review of the aforementioned documents and the Safety Report, and discussions with the RSEs and Responsible Design Engineers (RDEs) determined the extent to which each group of SSCs met their design requirements. The conclusions were confirmed by a review of the SCR database and TOEs. RSEs and RDEs are instructed and other staff encouraged to flag situations when SSCs do not meet their design requirements.

The more recent SHRs are standardized to identify items, such as occurrences of Functional Failures, high maintenance backlogs, SCRs, S-99 (REGDOC-3.1.1) reports and TOEs. Functional Failure for System Health reporting is defined as any change in a component that would result in the system being unable to perform its minimum intended function or to operate within specification. The functions include those related to safety, e.g., shutoff rod falling in core is failing safe. The SHRs are heavily weighted to flag these situations with a 25% weight[28] ([78] Appendix E).

The updated SHRs show the extent of compliance and discuss potential improvements. These reviews confirm the extent of compliance against this element. A detailed review [101] summarizing the status for systems important to safety and production shows overall good and upward trending performance (see Section 5.1).

In addition, the ALPO/LCMP process (using CARs and SHRs) has reviewed operating history to provide an estimate of the remaining operating life.

Therefore, Bruce Power meets the requirements of this review task, recognizing that improvements in documentation occur as SSCs are modified, as required by BP-PROG-10.2 [86].

5.11. Dependence on Obsolescent Equipment for which No Direct Substitute is Available

This section addresses review task 10.

Bruce Power's Asset Management Program is about predicting component life and planning for its replacement in a systematic strategy combining safety, operating efficiencies, and revenue projections (see Section 5.6). Obsolescence management is a key component of the program.

Generically, obsolescence awareness is a fundamental engineering value expressed in Appendix A of BP-PROC-00582 [46], "Proactively identify degraded equipment conditions or repetitive equipment issues through performance monitoring activities and trend analysis". When a component is not available or the supply line is threatened, a search for a suitable replacement follows. As discussed in Section 4, procedurally BP-PROC-00533, Obsolescence Management [50] is a framework for predicting and addressing obsolescence issues. The procedure suggests many options for addressing obsolescent components – repairs, cannibalisation, reanalysis, and redesign/replacement are among the obvious. This is an ongoing and systematic process, especially in the context of Asset Management.

Over the years, there have been high profile cases of obsolescence that have been accommodated for long periods of time through workarounds. The obsolescence of the

[28] Weighting is used to give prominence to one aspect or another to produce a higher or lower score, which determines the "colour" of the assessment.

Varian™ computers, a crucial component of the plant DCCs, is one such case that has been known for at least 30 years. Replacement of the obsolete components is expensive both in terms of capital cost, outage costs, documentation costs (far reaching ripple effects) and engineering "software" (e.g., software QA of the replacement machines). The inevitable has been delayed by developing emulators (other processors that adequately replicate the Varians), buying up parts from other industries abandoning the Varian (e.g., US Navy), and adding supplementary peripherals. The AMOT process (see Section 5.2) has produced an assessment of the Varian with one option for replacement in the time frame of this ISR.

Another example is the impending expiry of the EQ of the adhesive on the seals of the vacuum building Auxilliary Pressure Relief Valves (APRVs) and Instrumented Pressure Relief Valves (IPRVs). The supplier has gone out of business and another has not been found. The time to repair each Pressure Relief Valve (PRV) is significant. This item has been known for some time; for example in the SHR Q3 2013, SHR Q1 2013, and the 2012 Condition Assessment Report [113]. The CAR mentioned a COG Obsolescence Working Group awareness on the topic.

A number of deliberate deferrals raised the priority of this replacement to a significant threat to requiring an extended 4 unit outage when the deferral expiry time was November 2015. Following a reassessment in early 2015, EQ Engineering has now confirmed the end of life of the adhesive to be November 2017. The station risk log has accordingly been revised from Red to acceptable. There is still some risk with the timing, planning and execution of the EQ component replacements for the 16 PRVs/IPRVs. If the work cannot be executed prior to the new date, the affected PRVs/IPRVs would be considered unavailable, which would lead to an impairment and potentially a station shutdown.

There is also a potential issue with the ~400 EQ PMs for Containment Penetrations that are due in 2016/2017. The EQ Dossier states that they have a greater than 40 year qualified life; however, EQ Design will need to carry out an evaluation on all the EQ components to extend their end of life past 2016/2017. EQ Design is aware of this concern and will be completing the evaluation prior to the EQ end of life dates. Engineering has raised this item and it has an elevated risk log rating.

Therefore, Bruce Power meets the requirements of this review task, recognizing that obsolescence management is a key component of Bruce Power's Asset Management Program.

5.12. Dependence on Essential Services and/or Supplies External to Plant

This section addresses review task 11.

Off-site support is available from manufacturers and construction companies in Canada and overseas. Bruce Power Supply Chain and Procurement Engineering maintains an ongoing relationship with its major suppliers.

On-site support includes the following facilities:

- Large Bore Facility. The Large Bore facility consists of three shops: the Plate Shop, the Pipe Fabrication Shop, and the Hand Rail shop. These shops can fabricate a wide range of items required, such as: piping systems (1" to 66" inch piping), instrumentation panels, steel platforms, bridges, beams, columns, and handrails. Moreover, they can handle all welding and cutting of steel (including stainless, carbon steels) and aluminum.

- Paint and Sand Blast Shop. The Paint and Sand Blast Shop can handle large objects that require painting. The shop has a sandblasting area and a paint shop area (both primer and finishing coats).
- Central Maintenance and Laundry Facility. The Central Maintenance and Laundry Facility is an ISO 9001 qualified shop that provides a complete range of machining services.
- Measuring & Testing Equipment (M&TE) Lab. The M&TE Lab calibrates Electrical, I&C and Mechanical Dimensional M&TE for the Bruce Site. Calibrations are performed to traceable standards. Calibrations are documented and reports are generated for follow-up actions in the event M&TE is found out of calibration. In addition, inspections in support of site manufacturing are performed.
- Portable Radiation Instrument Shop. The Portable Radiation Instrument Shop performs calibration and service for a variety of portable instrumentation used for measuring hazards such as gamma radiation, beta radiation, alpha radiation, tritium in air, airborne contamination, toxic gases, and oxygen levels. The shop supplies technical support for radiation detection equipment permanently installed in the stations.
- Breaker / Starter Shops. The breaker / starter shops provide testing and refurbishment of a range of breakers and motor starter cells.

A detailed review [101] summarizing the status for systems important to safety and production shows overall good and upward trending performance (see Section 5.1).

Given the support of suppliers and contractors plus the availability of a range of on-site maintenance facilities, the conclusion is that Bruce Power meets the requirements of this review task.

5.13. Condition and Operation of Spent Fuel Storage Facilities

This section addresses review task 12. As part of the commercial agreement between Bruce Power and Ontario Power Generation, OPG is responsible for the storage of spent fuel once it leaves the station(s)[29]. This section describes the Bruce Power activities at the Bruce A station.

The key Bruce Station SSCs that form the used fuel storage facilities include the following:

- Primary and Secondary Irradiated Fuel Storage Bay Structures (NuSCI 24100 (Central Fuelling Area) and 24500 (East Service Area), and 24400 (Ancillary Services Building) respectively);

[29] The physical and administrative transfer of the Spent Fuel occurs at the Auxiliary Services Building door where Bruce Power presents the loaded Dry Fuel Storage Container (cask), OPG personnel accepts the cask, and OPG's transporter delivers it to the Waste Management Facility.

- Irradiated Fuel Bays System including the Primary (34410) and Secondary (34420) Irradiated Fuel Cooling and Purification Systems, and the Dry Storage Container (DSC) Loading Bay Pumpdown System (34430) (NuSCI 34400 and 63440); and
- Used Fuel Dry Storage SSCs (NuSCIs 35300 (Fuel Transfer and Storage) and 63530).

The condition of aforementioned SSCs has been reviewed and assessed, and is documented in [114][115][116][117]. Furthermore, as part of the SHR process, the SHRs for these systems are regularly updated. Changes in these systems are more passive than reactor systems, and therefore they have been classified as tier 3 systems [78]. Regardless, their condition and operation is fully updated at least annually.

Leakage from the bays is monitored and when practicable stopped. When it cannot be eliminated, it is stabilized, and maintained at acceptable levels. It is collected by drainage systems and transferred to the liquid waste handling ([116] Section 1.3.3) and the design of the bays allows inspection of the concrete ([116] Section 1.3.9).

For the period Q2 2012 to Q3 2013, the SHRs [118][119] show the Bruce A Used Fuel Storage was generally Green or White continuously, while the Bruce A Irradiated Fuel Cooling and Purification Systems was on occasion rated Yellow.

The DSC loading bay is used in the shipment of the used fuel bundles, and does not typically contain fuel, unless it contains a DSC.

There has been a continuing priority on ensuring that sufficient fuel is shipped to maintain adequate spare capacity in the bays to receive irradiated fuel from the reactors. As reported in the interim PSR [2], in 2013 Bruce A had completed 65 DSC shipments with 10 more expected by year 2013 end [120]. Functional failures had decreased since the last reporting period. Work Orders that threaten to delay shipments were given higher priority.

In a sample of three sequential Management Review Meetings in October to December 2014, the Primary Irradiated Fuel Bay (PIFB)/ Secondary Irradiated Fuel Bay (SIFB) Risk is either unrated (assumed acceptable) or Green, indicating that sufficient capacity is being maintained [121].

In terms of performance, a strategic action plan includes improvements for dry fuel storage. Bay water chemistry is managed and the Irradiated Fuel Cooling and Purification Systems are performing well [122].

The LCMP, B-PLAN-20000-00001 [123], for civil structures describes industry best practices for understanding ageing degradation of civil structures and components. It includes the management for ageing and degradation of the Used Fuel Storage Bays ([116] Section 2.5.5).

Bruce Power is routinely able to transfer spent fuel canisters to OPG to manage the spent fuel inventory in the bays. The condition and operation of the used fuel storage facilities are routinely reviewed and monitored. Therefore, Bruce Power meets the requirements of this review task.

5.14. Verification of Actual State of SSCs against Design Basis

This section addresses review task 13.

Bruce Power has extensive programs that support this activity, some of which have been in place since the plant began operation, but most of which have been enhanced since the focused review on asset management (life cycle management) was initiated.

As stated in BP-PROG-10.01 R009, Plant Design Basis Management, Bruce A PROL 15.00/2014 Clause 5.1 requires that "*the licensee shall implement and maintain a plant design basis management program such that the structures, systems and components continue to meet the design basis and the plant can operate safely for the full duration of its design life.*" BP-PROG-10.01 then claims that the requirement is fulfilled by BP-PROG-10.01, Plant Design Basis Management and its implementing procedures, including BP-PROC-00335, Design Management, and BP-PROC-00363, Nuclear Safety Assessment [106]. It also defines Design Basis: as "The range of conditions and events taken explicitly into account in the design of a facility, according to established criteria, such that the facility can withstand them without exceeding authorized limits by the planned operation of safety systems. [IAEA Safety Glossary, 2007 Edition, Page 51]"

Section 4.1.3.4, "Design Basis", of the CA Summary Report [97] (see footnote 14 Page 34) and Safety Factor 1 of previous assessments [11] concluded that there is no single roadmap to the distributed documentation available that describes the design basis of each SSC. An understanding needs to be obtained from reviews of System Design Manuals; the Safety Report (which supports the PROL); OPEX (Technical Operability Evaluation, SCR and Corrective Action feedback); and inputs from SMEs. Additional design basis information is captured in system correspondence files and communication with the Regulators.

For Bruce A as part of restart activities, the Units 012 Design Manuals were updated, to capture refurbishment design modifications. Some of these documents are equally useful in updating and capturing the Units 3 and 4 design basis.

In the context of Condition Assessments and Design Basis, the programs mentioned in the preceding sections have elements of design basis associated with them. Testing and monitoring functions such as Periodic Inspection Programs, SSTs, Calibrations, and Component and System Monitoring Programs have acceptance criteria based on the components' or systems' design basis. In the Asset Management environment, these items contribute to the LCMPs, which apply an additional layer of review of design basis in establishing continued fitness for service and estimating remaining life.

In addition to the above programmatic statement, the following items are typical of the integrated and component tests that are periodically performed to verify that equipment continues to meet the minimum requirements of the design:

- A trip test is performed at the start of a scheduled outage every two years either using SDS1 or SDS2. In addition to verifying that the SDS meets the minimum negative reactivity insertion rate, the test also provides information to verify that the prompt fraction of in-core flux detectors still meets the minimum standards.

- The SST for Emergency Boiler Cooling verifies that the system is able to deliver the rated flow under simulated conditions.
- The single and full rod drop tests for shutoff rods demonstrate the speed of insertion of the SORs continues to bound the analysis assumptions.
- The SDS2 channel trip tests verify that the Quick Acting Valves operate in time to pressurize the helium header for SDS2 injection.
- Air holding tests verify that the instrument air receivers are capable of operating the supplied loads.

Bruce Power meets the requirements of this review task.

6. Interfaces with Other Safety Factors

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

- “Safety Factor 1: Plant Design” in Section 5.4, addresses the design process and programmatic review of Bruce Power Program documents BP-PROG-10.01 and in Section 4.1.1 BP-PROG-00.04 in terms of adequacy as they relate to plant design.
- “Safety Factor 3: Equipment Qualification” in Section 5.1 addresses the environmental qualification process for SSCs and in Section 4.2 performs a programmatic review of the following Bruce Power Procedure document BP-PROC-00261 in terms of adequacy as it relates to environmental qualification.
- “Safety Factor 4: Ageing” in Section 4.0, addresses the programmatic review of BP-PROG-11.04, BP-PROG-12.02, BP-PROC-00781, BP PROC-00383 and BP-PROC-00400 in terms of adequacy as they relate to ageing. A high level code-to-code comparison between the 2014 and 2009 versions of CSA N285.4 is presented in Appendix A (Section A.1) of Safety Factor 4.
- “Safety Factor 5: Deterministic Safety Analysis” in Sections 5.2 and 5.3, addresses the design analysis process to maintain and enhance safety and in Section 5.4 addresses the implementation of a Safe Operating Envelope Program which provides a comprehensive identification of all operating limits and conditions in compliance with the requirements of CSA N290.15.
- “Safety Factor 6: Probabilistic Safety Analysis” in Section 5.1, addresses the use of SSCs condition information and classification processes to maintain and enhance safety.

7. Program Assessment and Adequacy of Implementation

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

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

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

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

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

7.1. Self-Assessments

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

The self-assessments:

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

- Identify adverse conditions and Opportunities for Improvements (OFI); and
- Identify the specific improvement corrective actions to close the performance/programmatic gap.

Self-assessments relating to CA that were conducted since 2010 are listed in Appendix E. The most pertinent ones are discussed in the following sections.

7.1.1. FASA Results

7.1.1.1. SA-ERI-2013-11, Benefits Realization for Ventyx ER Suite

This FASA is important to Condition Assessment because the Equipment Reliability suite of software controls the production of System and Component Health Reports and assists with Maintenance Planning (see Section 7.1.1.7). This FASA explored the benefits of Bruce Power's implementation of the Ventyx IQ software suite. It reviewed the following applications, SystemIQ, ComponentIQ, ProgramIQ, PlantIQ (Upgrade), Pro-Active Maintenance (PAM) ManagerIQ, and IQ Review.

From a Condition Assessment perspective, the FASA confirmed the benefits of the system in terms of the ability to produce reports on time (SystemIQ™), with reduced errors, with direct connections to other station databases (e.g., PassPort) to automatically extract the health report and compute the System Health Index (RSE has the option to downgrade the rating, if in his/her opinion it is not representative).

The primary benefit for System Health Monitoring was the 40-80 hours reduction to produce a uniform standard and accurate SHR. For Maintenance, the FASA identified that the PAM ManagerIQ needed to be updated because the older version was no longer supported.

Overall, the software suite exceeded the expectations of the Equipment Reliability Integration department.

7.1.1.2. SA-ERI-2013-08, Effectiveness of ERCOE Implementation

This FASA is important to Condition Assessment because it places more emphasis on supporting the Equipment Reliability Centre of Excellence (ERCOE), thereby improving safety and production reliability. This FASA was selected because it relates to the Buried Pipe FASA in the next subsection.

This FASA was an outcome of the discovery of leaks from buried EPG fuel oil lines. One of the Corrective Action to Prevent Recurrence (CAPR) assignments was to determine why the event was not predicted by the new ERCOE and therefore leaking fuel lines would have been avoided by inspection/preventative maintenance.

The resulting investigation showed that the recurrence was related to insufficient staff and that the program would be more effective if the startup organization been able to fill the open positions.

7.1.1.3. SA-ERI-2013-06, Execution of 2013 Buried Piping Inspection Scope - Lessons Learned

This FASA from December 2013 is an example of the use of FASAs to record and analyze lessons learned from a Condition Assessment-related program. Buried piping is one category that has also received ALPO attention. (The confidential ALPO report on Buried Piping was issued shortly after this FASA, January 2014.)

This FASA was intended to identify strengths and opportunities for improvement associated with the implementation of the Buried Piping Inspection Program (BPIP), to document Lessons Learned, and to initiate corrective actions where appropriate to ensure continuous improvement and success of future inspection campaigns. It used mainly Bruce B OPEX (there was at least one Bruce A OPEX related to coatings), but because the program is applied site-wide, it is equally applicable to Bruce A.

The FASA developed a number of lessons learned, for example that high risk piping that was not previously inspected due to being difficult or not feasible to inspect via excavation should be inspected through application of alternative qualified inspection methods and techniques. It also provided insight into the activities of the Buried Piping Program and identified opportunities for improvement as documented in an SCR for follow-up in a managed process.

7.1.1.4. SA-ERI-2014-07, Quality of System Health Reporting

This FASA is important to Condition Assessment because it impacts the efficiency of the process and thus on the effectiveness of the SHRs and upgrades to systems resulting from it.

The scope of this FASA included:

- Assessing the quality of the System Health Reports, with respect to DPT-PE-00010, "System Health Reporting"[78] and identifying gaps to excellence and opportunities for improvement; and
- Assessing how effectively the content of the System Health Reports are communicated to influence decision making, with respect to the reporting requirements of DPT-PE-00010, "System Health Reporting" and identifying gaps to excellence and opportunities for improvement.

The findings of the FASA concluded a need to strengthen communications and line of responsibility in procedures governing the SHRs (e.g., advancing items to the SPHC for resolution). Although there was a general understanding that the SHR System Health Improvement Plans (SHIPs) should be presented to the SPHC for endorsement, RSEs were unsure exactly which SHIPs needed to be presented to SPHC (all or only certain overall health colours). As a result, it was determined that few RSEs are making this presentation which is resulting in other important non-project SHIP WOs not getting proper SPHC endorsement to help drive them through the Work Management Process with better success of completion.

Implementation of the recommended actions from this FASA would result in:

- improved quality of SHRs by enhancing the System Health Reporting procedure (DPT-PR-00010) with identified opportunities for improvement to clarify and consolidate error-likely sections; and
- improved quality of SHRs by producing a new (overhauled) quality review checksheet that will align with both the procedural requirements and SystemIQ™ format and by increasing the rigor of quality checks by adding an additional Section Manager review with the new (overhauled) checksheet.
- improved Equipment Health by enhancing the integration of System Health Reporting (DPT-PE-00010) and Station Plant Health Committee (BP-PROC-00559) procedures to provide clearer procedural guidance for the appropriate communication of System Health Report content to decision makers, to assign appropriate priority (endorsement) on the appropriate work to maximize the effectiveness of the Work Management process.

7.1.1.5. SA-ERI-2014-08, SmartSignal™ Performance Monitoring Effectiveness

This FASA is important to Condition Assessment because this system has the potential to enhance monitoring of a wide range of plant parameters using digital signals, e.g., from the plant computers.

SmartSignal™ is a pattern recognition monitoring system which allows monitoring of Instrumentation and Control signals from PI (Plant Information system), to alert strategy owners when undesirable trends begin to emerge.

There have been a number of attempts at implementing this program. Efforts in 2012 and 2013 had the necessary Corporate resources to allow for a systematic approach to developing, testing, and optimizing the performance models for the various systems at Bruce A and B. Bruce A was fully implemented by the end of 2013. Since the fall of 2013, a decline in resources supporting SmartSignal™ has reduced the effectiveness and sustainability of this program.

This FASA sent a survey to the ~60 technical staff who were initially trained on SmartSignal (11 responses). The following observations from the survey were considered in the assessment:

- The backlog of model maintenance is growing, which leads to increasing nuisance alerts.
- Additional focused training is desired for certain aspects of the program (e.g., guidance for dispositioning advisories, periodic continuing training).
- A large number of engineers were initially trained on SmartSignal but currently (for various reasons) a small number of regular users exist. Consideration for a more focused group for subsequent training and discussions.

- Based on feedback from the survey and general level of awareness, the benefits of the SmartSignal™ program are not well known on site[30].

The FASA concluded the SmartSignal™ Program can be improved by providing support from the Equipment Reliability Integration section in a number of ways; e.g., provide oversight to the program to ensure that users are able to execute their performance monitoring functions efficiently, and produce program metrics on a periodic basis.

The FASA follow-up actions were documented in a single SCR to track the completion of actions in a managed process.

7.1.1.6. SA-ERI-2014-06, Heat Exchanger Program Records

This FASA is an example of the attention to providing convenient and accurate access to records to facilitate Condition Assessment as per ISR review task 8 (see Section 5.9).

This FASA examined the storage of heat exchanger inspection reports. Previously, HX inspection reports were stored in several distributed locations, making it difficult to locate reports to determine the history or current state of a heat exchanger.

Implementation of the recommended actions from this FASA will result in inspection reports being stored in a well-defined and logical location. Implementation will also result in heat exchanger inspection reports being stored in records in accordance with BP-PROG-03.01 and BP-PROC-00098.

Two SCRs were raised to track the completion of actions in a managed process.

7.1.1.7. SA-SA-ERI-2013-08, PM Program Self Assessment

The Preventive Maintenance program has a direct impact on Condition Assessment.

The objective of this FASA was to assess the Preventive Maintenance program to determine a focused recovery plan based on EPRI standards and experience from the Nuclear Industry. It was executed by a team comprised of four Bruce Power staff and three external experts (Darlington, Ginna and Wolf Creek Nuclear Generating Stations).

The team focused on 8 key elements of the program as follows:

- PM Deferrals
- PMs scheduled deep in grace period (more than 50% into grace period before completion)
- PM Change Request (PMCR) Backlog
- PM Just In Time (JIT) Process

[30] The April 23, 2015 Bruce Power internal site wide publication, The Point, included a feature article on the benefits of SmartSignal™ in preventing failures, supporting Condition Based Maintenance.

- Craft Feedback
- Training Qualification (PM Co-ordinator)
- PM Basis
- PM templates.

Observations included such things as poor engagement by groups within the sector (some outstanding exceptionally good behaviour also noted), inconsistent knowledge of the basis for some PM activities, poor awareness of the impact of missed PMs, large backlogs with no apparent system for working them down, and training needs assessment required. Twelve areas for improvement were identified by the teams. Opportunities that were highlighted by the Team included:

- Single repository of Maintenance strategy information, increased knowledge/proficiency in the Maintenance software suite (Ventyx IQ System) (2 items), meetings require more engagement both in preparation and roles and responsibilities;
- assignment of additional temporary staff to reduce backlogs, need for filtering the PM backlogs to understand the consequences of not performing and clearing out unnecessary items, better training for Engineering on deferral and change control, JIT meetings should incorporate plant condition status and craft feedback, routine analysis of equipment failures, better oversight and validation of new PMs, consider opportunities for Condition-based Maintenance, monthly review of deferral reasons to develop and apply lessons learned.

The follow-up actions were defined in an SCR to track the completion of actions in a managed process.

7.2. Internal and External Audits and Reviews

The objective of the audit process as stated in BP-PROG-15.01 [124] 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 [125]).

This section addresses audits related to Condition Assessment. Internal audits are conducted by the Bruce Power Corporate Risk Oversight and Audit Division. External audits are conducted by independent third parties, excluding the regulatory authority for the purposes of this section.

7.2.1. Internal Audits

This section contains information on internal audits related to procedures and performance experience related to Condition Assessment. Audits relating to Condition Assessment that were conducted since 2010 are listed in Appendix E.

7.2.1.1. AU-2013-00006, Maintenance

Maintenance is the foundation of maintaining the actual state of SSCs in operable condition. The PROL requires that Bruce Power implements and maintains a maintenance program in accordance with CNSC S-210, Maintenance Programs for Nuclear Power Plants. This audit found that program document BP-PROG-11.04 Plant Maintenance is structured to match the sections of S-210 and that all major components and the majority of all the specific requirements of S-210 are covered. However, the audit found that BP-PROG-11.04 Plant Maintenance is not fully complete and is not fully implemented in documentation.

The audit observed that maintenance groups required significant upgrades to formal qualifications.

The audit recorded a strength in that Maintenance Peer Group meetings are held regularly. Meetings include maintenance representatives from across site and meaningful metrics are reviewed and discussed. This provides the Maintenance Corporate Functional Area Manager with good information regarding the effectiveness of the Program.

Overall, this audit identified five adverse conditions and two opportunities for improvement. These findings resulted in seven SCRs for follow-up in a managed process.

7.2.1.2. AU-2013-00018, Fluid Leak Management Program

This audit was performed in 2012 at the request of the Bruce B Plant Manager as part of an effectiveness review for an SCR follow-up action. The management of fluid leaks at the stations was evaluated against BP-PROC-00673 R001, Fluid Leak Management Program (FLMP) requirements and referenced procedures.

The audit made use of OPEX (Benchmarking Trip to McGuire Plant, a Unit 7 Leak Incident, and SCR Searches). In addition, the Audit used an EPRI Nuclear Maintenance Applications Center (NUMAC) guideline on Fluid Sealing Technology.

The audit concluded that BP-PROC-00673 R01 Fluid Leak Management was not fully implemented at Bruce A and B as staff did not always comply with the requirements. Bruce B had implemented the program to a greater extent than Bruce A but still the program was not completely effective so there had been little reduction in the backlog of fluid leaks at the stations and little evidence that fluid leaks, other than those of immediate concerns (H1 priority), were prioritized for repair based on their fluid type, severity and component criticality rating.

The program was not fully defined and integrated with interfacing procedures resulting in incomplete or conflicting instructions. This had contributed to:

- leaks not being identified as spills;
- leak WRs not being coded as leaks and as such not being included in station leak inventories;
- ownership of hazard postings being unclear;
- leak codes not always being used in determining scheduling priorities of new leak WRs; and
- leak codes not always being monitored through system health reports.

Operations staff expressed frustration that they were required to monitor a large number of leaks and the inability of the work management system to fix the leaks.

Oversight of the FLMP had not been completely effective at driving FLMP performance improvement through inadequate application of resources to advance and sustain the program. Goals and targets needed to be set and enforced to continually improve the FLMP driving the approach eventually to a Proactive Approach where leaks are prevented.

Three SCRs resulted from this audit. As of March 2015, the status of these SCRs are as shown in Table 10.

Table 10: Status of FLMP SCRs

SCR	Title	Status
28351427	Audit — Development of FLMP not Fully Effective	All actions COMPLETE as of 29AUG2014 except for FLMP FASA, scheduled for completion 30SEP 2015 AR closure schedule 13NOV2015.
28351429	Audit - Noncompliances with Fluid Leak Management Program	All actions COMPLETE or declared not required (CANCELED) by 06AUG2014 AR closure schedule 18MAR2015.
28351431	Audit - Noncompliances with Fluid Leak Management Program	All actions COMPLETE or declared not required (CANCELED) by 12DEC2014 AR closure schedule 18MAR2015.

In summary, the audit identified opportunities for improvement of the Fluid Leak Management Program that would lead to improved performance in detecting, prioritizing, and resolving leaks and spills, as well as improving employee morale and workplace culture. Actions to address the opportunities are being handled in a managed process that is well on its way to completion.

7.2.1.3. AU-2012-00006, Equipment Reliability

This audit of the Equipment Reliability functional area assessed the draft BP-PROG-11.01 R003 [R004][31] Equipment Reliability program and implementing procedures for completeness and implementation against the following criteria:

- BP-MSM-1 R010 [R012] Management System Manual
- BP-PROC-00774 R002 [R002] Program Requirements
- BP-PROC-00166 R021 [R023] General Procedure and Process Requirements
- BP-PROC-00068 R018 [R021] Controlled Document Life Cycle Management
- BP-PROC-00138 R002 [R002] Regulatory Requirements

At the request of the Department Manager, Component and Program Engineering a review was conducted of the following procedures against the industry best practice INPO AP-913 Rev 3 Equipment Reliability Process Description.

- BP-PROC-00666 R000 [R003] Component Categorization
- BP-PROC-00534 R001 [R002] Technical Basis Assessment (draft)

This audit did not include Pressure Boundary elements that exist under the Equipment Reliability functional area because compliance to Pressure Boundary elements is covered in the annual Pressure Boundary audit.

The FASA had the following observations and conclusions:

- Upgrades to the program document and some implementing procedures will make them compliant with the standard format as required by Bruce Power's Management System.
- The Program's processes for Single Point Vulnerability and Technical Basis were observed to be in good alignment with INPO AP-913 Rev 3.
- Equipment Life Cycle Engineering (ELCE) Management has performed well in identifying program issues through 17 FASAs completed within the last 3 years. However, more effective use of the SCR and corrective action tools will improve compliance for some of these identified issues.
- ERI (Equipment Reliability Integration) Managers were aware that the current program document BP-PROG-11.01 R002 Plant Reliability Integration[32] is out of date so R003 draft was used for the Audit.

[31] Revision numbers in square brackets indicate the present revision of the document.
[32] Renamed Equipment Reliability at R003. R004 is presently issued.

- The audit concluded that staff do not always create or revise procedures and programs following the requirements outlined in BP-MSM-1 and associated procedures. Improving performance in getting the updates created and issued will avoid delays and re-work.
- The Duke Energy Technical Specialist noted 2 opportunities for improvement associated with BP-PROC-00666 R000 Component Categorization. The SPV procedure is not aligned with INPO AP-913 and INPO 01-004 "Achieving High Equipment Reliability - A Leadership Perspective" in regard to the elimination of design vulnerabilities as an SPV management/mitigation strategy. Also the SPVs need to be incorporated in preventive maintenance work orders for deferral and when scheduling first time Preventive Maintenance Work Orders (PM).

Three adverse conditions and two opportunities for improvement were generated based on the above observations. Five SCRs were opened to track the resolution of adverse conditions and opportunities in a managed process.

7.2.1.4. AU-2011-00028, Performance and Condition Monitoring

The following is an example of an audit that was conducted several years ago and follow-up actions have been implemented. The description is correspondingly appropriately brief.

An internal audit against BP-PROC-00498 [64], was conducted in 2011 [126]. It was done on the Performance and Condition Monitoring Process based on BP-PROC-00382, which has been superseded by BP-PROC-00781 [56]. Based on this audit, improvements were made to the instructions on how to complete SPMPs and SHRs. Furthermore, improvements were made to the then newly acquired SystemIQ™ software for creating SHRs.

7.2.1.5. AU-2013-00005, RV Field Repairs

Relief valves support the operating limits for systems and are therefore pertinent to Condition Assessment. See review task 2, Section 5.3.

This audit supports BP-PROG-11.01 Plant Reliability Integration[33] and meets the requirements of ANSI NB-23 National Board Inspection Code to evaluate Relief Valve (RV) field repair activities each year.

Bruce PROLs require a sustained pressure boundary program to carry out the pressure boundary activities for the nuclear facility in accordance with the requirements of CSA N285.0. In turn, N285 requires the servicing of pressure-relief valves (Class 1, 2 & 3) to be based on ANSI/NBBI National Board Inspection Code (NBIC). NBIC Part 3 specifies Audit Requirements as: Upon issuance of a Certificate of Authorization, provided field repairs are performed, annual audits of the work carried out in the field shall be performed … The audit shall include, but not be limited to, performance testing, in accordance with NBIC Part 3, 4.5, of valve(s) that were repaired in the field.

[33] Renamed, Equipment Reliability at Revision 003.

The pressure relief valve program, accepted by the AIA, is required by CSA N285.0, as well as the station's Operating Policies and Principles. The program accepted by the TSSA is BP-PROC-00078, Quality Program Manual for Testing and Repair of Pressure Relief Valves, which requires annual audit of field repairs. “Field repair” is any repair conducted outside of the fixed repair shop location. The program also states that additional audits of testing and repair activities shall be conducted periodically.

The audit evaluated both nuclear and non-nuclear pressure relief valve program related activities at both stations. It encompassed a selection of work scheduled by the Passport work management process at Bruce A and B during the audit's conduct period. Additional reviews were conducted specific to Relief Valve Field Repairs. Observations included sampling of completed, ongoing and planned work, and records initiated after November 1, 2012.

The Bruce Power Relief Valve Quality Program field repair activities were found to be in compliance with the related Code requirements. However, some non-compliances with process procedures requirements and established Bruce Power expectations were observed. None of the identified non-compliances resulted in negative field consequences.

The testing and repairing of relief valves observed were performed in accordance with the Quality Program Manual, using calibrated tools, and following approved procedures. Applicable Code requirements were observed to be adequately established and effectively implemented.

Overall, the RV shops at Bruce A and B were observed to be in good condition, clean and orderly. All sampled M&TE calibrated assets were found properly stored and within calibration due dates. The audit team noted the strong ownership of staff and supervision that directly implement the Relief Valve Quality Program. All staff was forthcoming and helpful (good culture).

Relief valve activities and work that was taking place during the conduct of the audit within the maintenance shops and in the field, including reviewed records of work already completed, were found to meet most of the program requirements.

Four adverse conditions and two opportunities for improvement were identified as a result of the audit.

- RV Quality Program Documentation Inadequacies
- Unclear RV Assessor Qualification Requirements
- Ineffective Corrective Actions to identified problems
- RV UTC Trace Information Misalignments.
- OFI - Coordination of Audit Field Observations with scheduled in-situ RV activities
- OFI - Establishment of PRD Program Health Reporting Requirements.

The FASA team initiated one SCR per item for follow-up in a managed process.

7.2.2. External Audits and Reviews

To support the return to service of Bruce Units 1&2, Bruce Power hired an independent consultant to perform a systematic review of safety based on IAEA NS-G-2.10 [127]. Since the findings of that review with respect to CA were specific to the condition of Bruce Units 0, 1 and 2, they do not necessarily apply to Bruce Units 034. However, the CNSC's comments on the Bruce Units 1&2 Systematic Review of Safety included actions to improve the CA process [128]. The current review follows a documented process for the CAs, as required in [64], including demonstrating that a comprehensive and systematic approach compliant with CSA N286.2, encompassing identification of ageing related degradation mechanisms and obsolescence issues, time limited ageing assessments, and the basis for the scope and extent of system and component level inspections and tests.

INPO AP-913 "Equipment Reliability Process Description" [87], outlines specific process elements for the integration and co-ordination of a broad range of equipment reliability activities and combines these into one process. INPO AP-913 provides a systematic approach for plant personnel to evaluate condition, and make ongoing adjustments to predefined tasks and frequencies based on equipment experience. This process is based on a number of programs, such as reliability-centered maintenance, preventive maintenance, corrective maintenance surveillance and testing, LCM and performance/condition monitoring. As part of the ER Plan, an independent gap analysis assessment [129] was conducted to ensure that the station ER Integration Plan was aligned with INPO AP-913.

7.3. Regulatory Evaluations and Reviews

This section contains information on Regulatory Inspections related to procedures and performance experience related to Condition Assessment. Audits relating to CA that were conducted since 2010 are listed in Appendix E.

7.3.1. Condition Assessment Inspection by CNSC

In 2014, the CNSC conducted an extensive inspection of the Condition Assessment process. Because this inspection was so directly relevant and recent, summaries are provided of only two inspections in this category. Section E.3 of Appendix E provides a listing of correspondence directly or tangentially associated with Condition Assessment. Note that one inspection could easily generate three separate letters and that the Units 1 and 2 Startup generated a high volume of inspections.

The chronology of the inspections for this section is contained in a chain of four correspondence letters, as follows:

- NK21-CORR-00531-11054 [130], CNSC Type II Inspection - Condition Assessments
- NK21-CORR-00531-11262 [131], CNSC Type II Inspection - Condition Assessments
- NK21-CORR-00531-11380 [132], Action Item 2014-07-4687: CNSC Type II Inspection Condition Assessment Inspection - BRPD-AB-2014-002

- NK21-CORR-00531-11534 [133], Action Item 2014-07-4687: Bruce Power Responses to CNSC Type II Inspection - Condition Assessment Inspection - BRPD-AB-2014-002.

In the opening letter [130], the CNSC suggested modifications to the Condition Assessment procedure BP-PROC-00498 and announced a Type II Inspection on the topic of Condition Assessment for February 2014. Bruce Power responded [131] with the plans to update BP-PROC-00498 using Risk-Informed Decision Making. The scheduled revision of BP-PROC-00498 has been delayed awaiting the completion of other prerequisites [134].

Following the inspection, the CNSC issued their report that comprehensively captured a snapshot of the CA status with the following conclusions:

> "*Processes are in place to manage the ageing facilities and provide condition monitoring of the systems which include safety system tests, periodic inspection, assessments and operating experience (OPEX). System health reports and component health reports are produced on a routine basis and include items such as equipment failures, maintenance backlogs, aging and obsolescence issues. Bruce Power has also implemented Life Cycle Management Plans (LCMP) for some systems and is developing additional ones by 2016. Degradation mechanisms for all systems have been identified, assessed and are being monitored. Certain issues and uncertainties exist in some areas, however Bruce Power has initiated programs to understand and resolve these issues and uncertainties.*
>
> *CNSC staff has conducted a condition assessment inspection to verify that Bruce Power is aware of the current condition of their aging systems, structures and components. Observations on improvements to help alleviate the effects of ageing were made. Condition Assessment Reports (CARs) produced in 2011 provided many recommendations for improvements such as the completion of modifications and projects, maintenance activities and new inspections or tests to better monitor the condition of the equipment. All of this work has been prioritized based on a risk management process. CNSC staff has noted a reduced number of equipment failures and improvements in areas such as containment leak rates.*
>
> *Bruce Power is aware of the condition of the systems at their facilities and has implemented measures to ensure that systems remain fit for service and meet regulatory requirements over the next license period. CNSC staff will review the process for monitoring of the systems, e.g. LCMPs and the issues during future compliance activities*."

There were 6 action notices revolving around detailed observations of specific systems and processes at Bruce A and B, and four recommendations. Bruce Power has responded to the action notices with formal Action Tracking commitments (managed process) to address those not already completed. The only outstanding work at the time of writing this Safety Factor Report is the completion of two straightforward commitments, one on CSA N291, and the delayed commitment on BP-PROC-00498 [134].

This recent CNSC Inspection provides independent confirmation that BP Programs meet the overall intent of this Safety Factor.

7.3.2. Fukushima Followup Actions (Reactive Inspection)

The Fukushima event produced a significant reaction among utilities and regulators world-wide. In Canada, utilities and the CNSC developed a co-ordinated plan to address utilities' ability to respond to Beyond Design Basis Events (BDBE) such as Fukushima. This prompted a Type II inspection of Bruce Power's progress on the plan, held in the period March 7 to April 18, 2014.

This inspection is pertinent to Condition Assessment because it verifies the pre-existing and newly installed equipment to address BDBEs. It is recent, confirming the present status of station equipment and overall preparedness.

The CNSC conducted a compliance inspection to verify the completion of the Fukushima Action Items as per four Bruce Power semi-annual progress reports. This verification was a simple visual verification that equipment was procured and appropriate modifications were made to the station.

Paraphrasing from the CNSC summary letter [135] following the inspection, the inspection was part of a multi-pronged verification approach which includes the following additional elements:

- CNSC staff has previously witnessed emergency mitigating equipment (EME) deployment and the execution of field actions necessary to survive station blackout conditions in inspections and observations of emergency exercises.
- CNSC staff will be performing a more detailed documentation review of the EME technical specifications, commissioning plans, maintenance plans, and testing practices in future inspections.
- CNSC staff will conduct further inspections similar to this one to verify the completion of additional station modifications as they are completed by Bruce Power (i.e., heat transport and moderator makeup).

The inspection verified the following:

- Installation of modifications necessary for emergency makeup water to boilers and irradiated fuel bays (Section 4.1) [34]
- Installation of emergency electrical connections (Section 4.2)
- Procurement of emergency mitigating equipment (Section 4.3)
- Installation of Passive Auto Catalytic Re-combiners (Section 4.4)

The inspection noted 8 in-progress items as of June 2014[35]. Six of the eight items related to temporary connection provisions for EME; the seventh item related to overpressure protection

[34] In a previous review of the Irradiated Fuel Bays (IFBs) structural analysis [136], the CNSC staff assessed the Bruce Power information and analysis report on the IFB and found it acceptable. Based on that review, the CNSC closed FAIs 1.5.1, 1.6.1 and 1.6.2. This addressed the topic of the structural integrity of the IFBs in Beyond Design Basis Accident (BDBAs).

for the shield tank, and the eighth noted the in-progress installation of Passive Autocatylic Recombiners for Bruce A Units 0 and 3.

The one recommendation arising from the inspection involved provisions for emergency connection of external air supplies to make Unit 4 consistent with the other Bruce A units.

Overall, the CNSC inspection found Bruce Power's progress on the installation of mitigating equipment to address Fukushima type events satisfactory.

7.4. Performance Indicators

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

Bruce Power monitors a number of performance indicators related to the actual condition of SSCs, and related programs and procedures.

Program Health Reports are developed for engineering programs that are deemed critical to ensure safe and reliable plant operation, in order to meet Bruce Power's Equipment Reliability goals and continuous improvement. Equipment Cornerstones, included in the engineering program health reports, monitor critical component failures, adverse failure trends and life cycle management plans.

The Equipment Reliability Index (ERI) provides a numerical point value that is used to gauge the status of station and unit equipment reliability. The ERI is reviewed on a monthly basis by the Station Plant Health Committee and includes a number of sub-indicators such as Forced Loss Rate, Quarterly Forced Loss Events, ER Clock Resets and Safety System Unavailability.

With respect to plant inspections, the following performance indicators are monitored:

- Schedule compliance (proportion of work completed as scheduled (inage))
- Outage milestones (adherence to outage milestone requirements)
- Equipment unreliability due to inspection (instances of equipment failure due to incomplete or improper execution of inspection requirements).

Performance indicators relevant to life cycle management and maintenance of SSCs include functional failures and maintenance backlogs, as well as component ageing and obsolescence. The Performance Indicator for Station Rework is measured as a percentage of all corrective maintenance completed.

[35] Bruce Power has continued to respond diligently to the CNSC Fukushima Action Items (FAIs) with equipment changes/additions and associated procedural changes, Of the 36 Fukushima Actions raised by the CNSC, the most recent status report [137] shows that 31 were closed and 1 was not applicable. Of the previously closed items, 10 items were allocated to new action items and one action allocated to a previous 2009 action for final completion.

WANO performance objectives are standards for plant and corporate performance intended to promote excellence in the operation, maintenance, support and governance of commercial nuclear power plants. Bruce Power is adopting and implementing the WANO performance objectives and criteria in its ER processes [138] site-wide. Under Equipment Reliability, WANO performance objectives and criteria are identified in the areas of equipment performance, equipment failure prevention, long term equipment reliability and materials reliability.

In addition to the performance indicators monitored by Bruce Power, the CNSC produces an annual report on the safety performance of Canada's NPPs. The report for 2013, "CNSC Staff Integrated Safety Assessment of Canadian Nuclear Power Plants for 2013", issued in September 2014 [139], summarizes the 2013 ratings for Canada's NPPs in each of the 14 CNSC Safety and Control Areas (SCA), including fitness for service. The fitness for service SCA covers activities that affect the physical condition of SSCs to ensure that they remain effective over time. This includes programs that ensure all equipment is available to perform their intended design function when called upon to do so. For 2013, the Bruce A rating for the fitness for service SCA was "satisfactory".

8. Summary and Conclusions

The overall objective of the Bruce A ISR is to conduct a review of Bruce A against modern codes and standards and international safety expectations and provide input to a practicable set of improvements to be conducted during the Major Component Replacement in Units 3 and 4, and during asset management activities to support ongoing operation of all four units, that will enhance safety to support long term operation. The specific objective of the review in this Safety Factor is to determine the actual condition of SSCs important to safety and whether it is adequate for them to meet their design requirements. In addition, the review should confirm that the condition of SSCs is properly documented. This specific objective has been met by the completion of the review tasks specific to actual condition of SSCs.

Strengths identified during this review are as follows:

- The conditions of the U014 SSCs are now tracked in SHRs. Bruce Power continues to improve and streamline the SHR processes as part of ageing and asset management, integrating these improvements with their anticipated obsolescence, testing, inspection and maintenance programs.
- Bruce Power's preventive maintenance implementation is a station priority. The station management team monitors implementation and leaders enforce accountability.

There were no key issues arising from the Integrated Safety Review of Safety Factor 2. The following observations are made with respect to improvement opportunities previously identified:

- There were four potential improvement opportunities described in the interim PSR [2], although none required a direct IIP item [140].
- The condition of the SSCs of Units 018 has been assessed in [101]. A number of issues have been identified, but most are of low significance and are being tracked following the well-established Bruce Power managed processes, such as System and Component

Health Reporting. The SHRs, which initiate and track projects that improve the SSC conditions, are being implemented in line with their priority as determined by the SPHC. The situation with the EQ of the PRV adhesive, described in Section 5.11, is already being managed, as are others arising from the SHRs.

Bruce Power recognizes that a significant improvement in the station equipment health is a major contributor to achieving strong safety and successful business plan performances going forward as there will be fewer unplanned, forced outages and increasingly more predictable operations. Equipment health initiatives beyond those discussed herein are planned so the stations are positioned to achieve long-term equipment reliability and plant health.

Overall, Bruce Power meets the requirements of the Safety Factor related to actual condition of the SSCs. The review indicates that the current and planned implementations of the programs related to condition assessment are sufficient to support continued operation of Bruce A.

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

A.1. CSA N291-08, Requirements for Safety-Related Structures in CANDU Nuclear Power Plants

CSA N291-08 provides material, design, construction, fabrication, inspection, and examination requirements for safety-related structures for CANDU nuclear power plants. It is expected that this standard will be included in the LCH for the next operating licence.

To comply with CSA N291-08 Bruce Power intends to utilize the Research described in Reference [A-1] and experience gained from the aforementioned life cycle management plan, along with baseline inspection results from 2005/2006 conducted on a large portion of Bruce A and B structures to compile in-service inspection results for safety-related structures. Walkdowns and inspections of both stations were performed by certified professional engineers and civil field technicians qualified to CSA N287 General Requirements for Concrete Containment Structures for CANDU Nuclear Power Plants. Areas covered at Bruce A included Units 0, 3, and 4, East Services Area, Vacuum Building, Ancillary Services Building, Accumulator Building, Units 3 and 4 pump houses, and the old water treatment plant. Team members followed the visual inspection procedures. Detailed results of inspection findings were photographed, summarized and documented in reports, References [A-2] and [A-3].

Safety-related structures covered in this Standard are:

- Structures that support, house or protect nuclear safety systems
- Components of structures that are required for the safe operation and/or safe shutdown of the reactor; and
- Facilities for the storage of irradiated fuel and other radioactive waste material.

The in-service examination program required by CSA N291-08 is documented in NK21-PIP-20000-00001, R000, CSA N291 In-Service Inspection Program for Bruce NGS A Safety-Related Structures, September 2014 [A-4]. The inspection schedule and the report names for the safety-related structures to be inspected are included in the NK21-PIP-20000-00001.

With these provisions, Bruce Power will be compliant with N291-08.

Appendix A.1 References

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

No codes or standards relevant to Safety Factor 2 were subjected to a clause-by-clause assessment. This Appendix is retained only for consistency with the Appendix numbering scheme in all other Safety Factor Reports.

Appendix C – Units 014 Condition Assessment Reports

Title of CA	NuSCI #	Reference #
Valve Overview	04940	[C-1] [C-2]
Containment Structures and Buildings	20000	[C-3]
Airlocks and Transfer Chambers	21120/21122	[C-4]
Fuel Channels	31100	[C-5]
Calandria	31200	[C-6]
Shield Tank	31300	[C-7]
Neutron Flux Monitors	31740/31780	[C-8]
Control Absorbers	31770	[C-9]
Ion Chambers / and Amplifiers	31790/63715	[C-10]
Feeder Pipe Freezing System	31940	-[38]
Moderator Auxiliary Systems	32000	[C-11]
Main Moderator System	32100	[C-12]
Primary Heat Transport (PHT) System	33000/33100	[C-13]
PHT Auxiliaries	33100	[C-14]
Steam Generators and Preheaters	33110	[C-15]
HT Feed/Bleed/Relief/Storage & Recovery	33300	[C-16]
End Shield Cooling	34110/63411	[C-17]
Negative Pressure Containment	34200	[C-18]
Emergency Filtered Air Discharge and Post-Accident Radiation Monitoring Systems	34310	[C-19]
Emergency Coolant Injection	34330/63433	[C-20] [C-21]
Powerhouse Emergency Ventilation/Venting	34360/63436	[C-22]
Irradiated Fuel Bay – Primary and Secondary Cooling	34400	[C-23]

[38] There is a confidential one, NK21-31940-00001-1, issued to PassPort circa 8NOV2010.

Title of CA	NuSCI #	Reference #
Active Solid Waste Systems Spent Resin Storage System / Radioactive Filter and Resin Handling Systems	34540	[C-24]
Shutdown Cooling	34710/63471	[C-25]
Maintenance Cooling	34720	[C-26]
Liquid Zone Control	34810	[C-27]
Heavy Water Sampling	34940/63494	[C-28]
Heavy Water (D_2O) Systems, Transfer, Clean-up, Inventory, and BIOTS	34960	[C-29]
Annulus Gas	34980/63498	[C-30]
Fuel Handling Systems	35000	[C-31]
Reactor and Service Area Bridges	35220/35670	[C-32]
Main Steam Supply and Relief	36100	[C-33]
Steam and Feedwater Sampling Steam and Feedwater Chemical Addition and Sampling	36600	[C-34]
Reactor Vault & Fueling Duct Vapour Recovery Vapour Recovery Systems	38310 38320	[C-35] [C-36]
Heavy Water Cleaning and Upgrading	38400	-
Turbine & Auxiliaries and Turbine Governor	41100	[C-37]
Main Steam Reject	41180/64118	[C-38]
Main Generator and Auxiliaries	41200	[C-39]
Moisture Separators & Reheater Drains	41400/41500	[C-40]
Condenser & Auxiliaries	42110	[C-41]
Feedwater Heaters	43100	[C-42]
Boiler Feed and Condensate	43210/43230	[C-43]
Main Power Output	51000/52000	[C-44]
13.8 kV Class III/IV Distribution	53100	[C-45] [C-46]
4.16 kV Class III/IV Distribution	53200	[C-47] [C-48]

Title of CA	NuSCI #	Reference #
600 V Class III/IV Distribution	53300	[C-49] [C-50]
600 VAC/120 VAC/45 VDC Class II	53320/53520/ 55400	[C-51] [C-52]
Standby Generators & Associated Fuel Delivery Systems	54600	[C-53]
Class I 250 VDC & 48 VDC	55100/55200	[C-54] [C-55]
Cable, Conduit and Cable Tray	57000	[C-56]
Reactor Regulating System and Overall Plant Control	60040/63710	[C-57]
Communications	60230	[C-58] [C-59]
Instrumentation and Control (I&C) Generic Equipment System	60400	[C-60] [C-61]
Process Transmitters	60430	[C-62] [C-63]
Hydrogen Ignition System	62111	[C-64]
Channel Flow Measurement System	63101	[C-65]
Gaseous Fission Product Monitoring	63103	[C-66]
Failed Fuel Detection	63105	[C-67]
Channel Power Measurement	63106	[C-68]
Gas Chromatograph	63495	[C-69]
Unit Reactor Regulating	63710	[C-9][39]
Shutdown System #1	63720	[C-70]
Shutdown System #2	63730	[C-71]
Secondary Control Area	63760	[C-72] [C-73]

[39] Control Absorber CAR also includes NuSCI 63710.

Title of CA	NuSCI #	Reference #
D_2O Leak Detection	63851	[C-74] [C-75]
Digital Control Computers	66400	[C-76]
Safety System Monitoring Computer	66460	[C-77]
Fixed Area Gamma Monitors	67873	[C-78] [C-79]
Fixed Gaseous Process Monitors / Stack and Containment Monitoring	67876	[C-80] [C-81]
Tritium Monitoring	67878	[C-82]
Trash Removal / Vacuum Priming / CCW	71120/71240/ 71210	[C-83]
Service Water – Common Service Water Low Pressure Condenser Cooling Water	71300	[C-84] [C-85]
Fire Protection System – Unit Common	71400	[C-86] [C-87]
New Water Treatment Plant	71600	[C-88]
Inactive Drainage Active Drainage	71710 71720 79200	[C-89]
Emergency Boiler Cooling	71910	[C-90]
Reactor Vault & Fuelling Duct Atmosphere System	73120/67312	[C-91]
Powerhouse HVAC	73200	[C-92] [C-93]
Emergency Air Conditioning System R-316/-317 – Unitized Channelized Instrument and R-336 Unit QPS Rooms S420 Control Equipment, S414 Main Control, and S330 Common QPS Rooms R3-332 ECIS Recovery Room Area	73240 73440 73780	[C-92] [C-94]

Title of CA	NuSCI #	Reference #
Vacuum and ECI Buildings Heating and Ventilation	73500	[C-95]
Service Air	75110	[C-96]
Instrument Air	75120/67512	[C-97]
Breathing Air	75140/67514	[C-98]
Cranes and Hoists	76100	[C-99] [C-100]
Off-Gas Management	79320/67932	[C-101]

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[C-22] NK21-CAR-34360-00001-R001, Powerhouse Emergency Ventilation (PEV) System, Units 34 Condition Assessment Report, February 15, 2011.

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[C-28] NK21-CAR-34940-00001-R001, Heavy Water Sampling System, Units 34 Condition Assessment Report, March 24, 2011.

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[C-30] NK21-CAR-34980-00001-R001, Annulus Gas, Units 34 Condition Assessment Report, April 12, 2011.

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[C-34] NK21-CAR-36600-00001-R000, Steam and Feedwater Sampling, Units 34 Condition Assessment Report, June 10, 2011.

[C-35] NK21-CAR-38310-00001-R001, Reactor Vault and Fuelling Duct Vapour Recovery System, Units 34 Condition Assessment Report, October 28, 2011.

[C-36] NK21-CAR-38320-00002-R000, Vapour Recovery Systems, Unit 0 Condition Assessment Report, January 20, 2009.

[C-37] NK21-CAR-41100-00001-R001, Turbine & Auxiliaries and Turbine Governor, Units 34 Condition Assessment Report, June 20, 2011.

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[C-48] NK21-CAR-53200-00002-R000, 4.16 kV Class III Distribution System, Unit 0 Condition Assessment Report, March 3, 2009.

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[C-67] NK21-CAR-63105-00001-R001, Failed Fuel Detection System (Delayed Neutron Monitoring System), Units 34 Condition Assessment Report, February 22, 2011.

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[C-90] NK21-CAR-71910-00001-R001, Emergency Boiler Cooling, Units 34 Condition Assessment Report, June 15, 2011.

[C-91] NK21-CAR-73120-00001-R001, Reactor Vault and Fuelling Duct Atmosphere System, Units 34 Condition Assessment Report, September 22, 2011.

[C-92] NK21-CAR-73200-00001-R001, Powerhouse HVAC, Units 34 Condition Assessment Report, July 12, 2011.

[C-93] NK21-CAR-73000-00002-R000, Bruce A Unit 0 HVAC, Unit 0 Condition Assessment Report, May 15, 2009.

[C-94] NK21-CAR-73440-00002-R000, Bruce A Unit 0 Service Building Air Conditioning, Unit 0 Condition Assessment Report, April 15, 2009.

[C-95] NK21-CAR-73500-00002-R000, Vacuum and ECI Buildings Heating and Ventilation, Unit 0 Condition Assessment Report, October 15, 2008.

[C-96] NK21-CAR-75110-00002-R000, Service Air, Unit 0 Condition Assessment Report, September 10, 2008.

[C-97] NK21-CAR-75120-00001-R001, Instrument Air System, Units 34 Condition Assessment Report, September 27, 2011.

[C-98] NK21-CAR-75140-00001-R001, Breathing Air System, Units 034 Condition Assessment Report, September 22, 2011.

[C-99] NK21-CAR-76100-00001-R001, Cranes and Hoists, Units 34 Condition Assessment Report, July 27, 2011.

[C-100] NK21-CAR-76100-00002-R000, Cranes and Hoists, Unit 0A Condition Assessment, July 27, 2011.

[C-101] NK21-CAR-79320-00001-R001, Off Gas Management (OGM) System, Units 034 Condition Assessment Report, September 22, 2011.

Appendix D – Units 014 System Health Reports for Systems Important to Safety

Title of System Health Report	NuSCI#	Importance Basis	Reference #
		SIS /SOE / Fukushima	NK21 -014
Fuel and Reactor Physics	37000 / 03100	S-98 SOE	[D-1].
Moderator Auxiliary Systems	32000	SOE	[D-2] [D-3] [D-4]
Main Moderator System	32100	SOE	[D-5]
Primary Heat Transport (PHT) System	33000	SOE	[D-6]
PHT Auxiliaries HT Feed, Bleed, Relief	33100 33200/33300	SIS	[D-7] [D-6] [D-2]
Negative Pressure Containment	34200	SIS	[D-8]
Containment Structures and Buildings	20000	Fukushima	
Airlocks and Transfer Chambers	21120	SIS	[D-9]
Emergency Filtered Air Discharge and Post-Accident Radiation Monitoring Systems	34310	SIS	[D-10]
Negative Pressure Containment and Confinement		SOE	
Reactor Vault & Fueling Duct Vapour Recovery	38310		
Vapour Recovery Systems	38300	SOE	
		SOE	[D-11]
Hydrogen Ignition System	62111	SOE	

Title of System Health Report	NuSCI#	Importance Basis	Reference #
		SIS /SOE / Fukushima	NK21 -014
Reactor Vault & Fueling Duct Atmosphere System	73120	SOE	[D-12]
Vacuum and ECI Buildings Heating and Ventilation	73500	SOE	
End Shield Cooling	34110	SOE	[D-13]
Emergency Coolant Injection	34330	SOE	[D-14] [D-15]
Powerhouse Emergency Ventilation/Venting	34360	SIS	[D-16]
Shutdown Cooling	34710	SOE	[D-17]
Maintenance Cooling	34720	SOE	[D-18]
Annulus Gas	34980	SOE	[D-19]
Irradiated Fuel Bay – Primary and Secondary Cooling	34400	Fukushima	[D-20]
Fuel Handling Systems	35000	SOE	[D-21] [D-22] [D-23] [D-24] [D-25] [D-26] [D-27] [D-28] [D-29] [D-30]
Main Steam Supply and Relief	36100	SOE	[D-31]
Condensate and Feedwater	43200		
Condenser & Auxiliaries	42110	SOE	
Feedwater Heaters	43100		
Boiler Feed and Condensate	43210/43230		[D-32]
Class III and Class IV	53100	SIS	[D-33]
13.8 kV Class III/IV Distribution			[D-34]
4.16 kV Class III/IV Distribution	53200	SIS	
600 V Class III/IV Distribution	53300	SIS	

Title of System Health Report	NuSCI#	Importance Basis	Reference #
		SIS /SOE / Fukushima	NK21 -014
Standby Generators & Associated Fuel Delivery Systems	54600	SIS	[D-35]
Qualified Power System	54400	SIS	[D-36]
Reactor Regulating System and Overall Plant Control	63710	SOE	[D-37] [D-38]
Control Absorbers	31770		
Liquid Zone Control	34810		[D-39]
Channel Flow Measurement System	63101		
Gaseous Fission Product Monitoring	63103		
Failed Fuel Detection	63105		[D-40]
Channel Power Monitoring	63106		
Unit Reactor Regulating	63710		
Shutdown System #1 Shutdown System #2	63720 / 63730	SOE	[D-41] [D-42]
Neutron Flux Monitors	31740/31780		
Ion Chambers / and Amplifiers	31790/63715		
Service Water – Common Service Water Low Pressure Condenser Cooling Water	71300	SOE	[D-43] [D-44]
Emergency Boiler Cooling	71910	SOE	[D-45]
Heating Ventilation and Air Conditioning	73200	SIS	-

Title of System Health Report	NuSCI#	Importance Basis	Reference #
		SIS /SOE / Fukushima	NK21 -014
Emergency Air Conditioning System R-316/-317 – Unitized Channelized Instrument and R-336 Unit QPS Rooms S420 Control Equipment, S414 Main Control, and S330 Common QPS Rooms R3-332 ECIS Recovery Room Area	73240 73440 73780	SIS	[D-46] [D-47] [D-48]
Instrument Air	75120	SIS	[D-49] to [D-54]
Used Fuel Dry Storage	34400 35390	Fukushima	[D-55]

D.1. References

[D-1] CNSC S-99, Section 6.4.10, Reporting Requirements for Operating Nuclear Power Plants, March 2003.

[D-2] Moderator and Heat Transport Purification, System Health Report, Bruce Power, Bruce A, Q3 2013.

[D-3] Moderator Cover Gas, System Health Report, Bruce Power, Bruce A, Q3 2012.

[D-4] Moderator Poison Addition, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-5] Main Moderator, System Health Report, Bruce Power, Bruce A, Q1 2013.

[D-6] Main Heat Transport Circuit, Gland Seal Circuit, Feeders, Autoclaves, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-7] Feed, Bleed, Relief, Storage, and Recovery, System Health Report, Bruce Power, Bruce A, Q1 2013.

[D-8] Negative Pressure Containment, System Health Report, Bruce Power, Bruce A, Q1 2013.

[D-9] Airlocks, Transfer Chambers and Bulk Heads, System Health Report, Bruce Power, Bruce A, Q3 2012.

[D-10] EFADS and PARMS, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-11] Vapour Recovery, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-12] Reactor Vault and Fuelling Duct Atmosphere, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-13] End Shield Cooling System, System Health Report, Bruce Power, Bruce A, Q3 2012.

[D-14] Unit 0A Emergency Coolant Injection, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-15] Unit 1-4 Emergency Coolant Injection, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-16] Powerhouse Emergency Venting, System Health Report, Bruce Power, Bruce A, Q3 2012.

[D-17] Shutdown Cooling System, System Health Report, Bruce Power, Bruce A, Q3 2013.

[D-18] Maintenance Cooling System, System Health Report, Bruce Power, Bruce A, Q3 2013.

[D-19] Annulus Gas, System Health Report, Bruce Power, Bruce A, Q3 2012.

[D-20] Irradiated Fuel Bays and Systems, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-21] Fuel Handling Control Computers, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-22] Fuel Handling Inverters, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-23] Fuel Handling Power Tracks, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-24] Fueling Machine Bridges, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-25] Fueling Machine D2O Auxiliary System, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-26] Fueling Machine Flow Injection System, System Health Report, Bruce Power, Bruce A, Q3 2013.

[D-27] Fuelling Machine Air Auxiliaries, System Health Report, Bruce Power, Bruce A, Q1 2013.

[D-28] Fuelling Machine Heads and Suspensions, System Health Report, Bruce Power, Bruce A, Q1 2013.

[D-29] Fuelling Machine Transport Trolley and Elevating Table, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-30] New Fuel Transfer, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-31] Main Steam, Boiler Blowoff, Boiler Steam Relief, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-32] Condensate and Feedwater, System Health Report, Bruce Power, Bruce A, Q1 2013.

[D-33] Class III Electrical Distribution, System Health Report, Bruce Power, Bruce A, Q3 2012.

[D-34] Class IV Electrical Distribution, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-35] Stand By Generators, System Health Report, Bruce Power, Bruce A, Q1 2013.

[D-36] Qualified Power Generations and QPS System, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-37] Reactor Regulating System Hardware, System Health Report, Bruce Power, Bruce A, Q3 2013.

[D-38] Reactor Regulating System Software, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-39] Liquid Zone Control System, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-40] Failed Fuel Location, System Health Report, Bruce Power, Bruce A, Q1 2013.

[D-41] Shutdown System #1, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-42] Shutdown System #2, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-43] Service Water, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-44] Common Service Water, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-45] Emergency Boiler Cooling, System Health Report, Bruce Power, Bruce A, Q4 2012.

[D-46] Control Room and Chilled Water Systems, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-47] Powerhouse Air Conditioning, System Health Report, Bruce Power, Bruce A, Q1 2013.

[D-48] Powerhouse Heat and Ventilation, System Health Report, Bruce Power, Bruce A, Q3 2012.

[D-49] Instrument and Service Air, System Health Report, Bruce Power, Bruce A, Q2 2013.

[D-50] Instrument and Service Air, System Health Report, Bruce Power, Bruce A, Q4 2013.

[D-51] Instrument and Service Air, System Health Report, Bruce Power, Bruce A, Q1 2014.

[D-52] Instrument and Service Air, System Health Report, Bruce Power, Bruce A, Q2 2014.

[D-53] Instrument and Service Air, System Health Report, Bruce Power, Bruce A, Q3 2014.

[D-54] Instrument and Service Air, System Health Report, Bruce Power, Bruce A, Q4 2014

[D-55] Used Fuel Dry Storage, System Health Report, Bruce Power, Bruce A, Q4 2012.

Appendix E List of FASAs, Audits and Inspections, 2010-2014

This appendix lists the Bruce A and Center of Site FASAs, Audits and Inspection Correspondence in the period from 2010-01-01 to 2014-09-30. This Appendix is to be read in concert with Section 7 of the main report.

E.1. FASAs

FASA Number	FASA Title
SA-BAOP-2010-03	Conduct FASA on Reactivity Management DPTSOAC
SA-CHM-2010-05	Zebra Mussel control Critical review of the current status
SA-COM-2010-04	Fidelity of Configuration Information to Plant
SA-ELCE-2010-03	SECVP CHI Improvement for Valve Programs
SA-ELCE-2010-06	SECERI SPHC Effectiveness
SA-ELCE-2010-09	System Health Report Overrides and System IQ Application Assessment
SA-MPA-2010-02	Availability of Parts for FIN Team Work
SA-MPR-2010-01	Protective Relays
SA-MPR-2010-03	Maintenance Alterations
SA-NSAS-2010-05	Fuel and Fuel Channel Programs: Efficiency In Capturing Inputs and Issues
SA-PDE-2010-01	Seismic Qualification Procedure Adherence for Bruce A Engineering Changes
SA-PDE-2010-03	Readiness for Unit 1 and 2, AFR
SA-RS-2010-01	Impairments Manual Operational Effectiveness
SA-RS-2010-02	Safety System Test Scheduling and Monitoring
SA-RS-2010-03	Fuel Defect Management
SA-SAC-2010-09	Commissioning Readiness FASA for BP-PROG-11.01
SA-SAC-2010-11	Commissioning Readiness FASA for BP-PROG-11.03
SA-SAC-2010-12	Commissioning Readiness FASA for BP-PROG-11.02
SA-TRGD-2010-08	Engineering Qualifications
SA-COM-2011-03	CM Performance Indicators & Configuration Management Index

FASA Number	FASA Title
SA-COM-2011-04	Technical Effectiveness of Component & System Condition Monitoring Activities on EQ Applications
SA-COM-2011-10	Fidelity of Configuration Information to Plant
SA-ELCE-2011-02	Aging and Obsolescence Project Review
SA-ELCE-2011-06	ELCE - Automated Program/Component Health Reporting with IKS Programs
SA-ELCE-2011-08	Assessing the Interactions Between Departments for Improved Performance in Equipment Reliability
SA-ELCE-2011-10	Large Motor Program WANO AFI
SA-MPR-2011-03	Maintenance Line Management Reinforcement & Monitoring of Maintenance
SA-MPR-2011-05	Line Ownership of Maintenance Training
SA-MPR-2011-07	Valve Maintenance
SA-OCP-2011-01	Reactivity Management
SA-RPR-2011-01	Fixed Instrumentation Calibration & Maintenance Processes
SA-BPMS-2012-02	NORA Documentation Review against N286-05 Requirements and Understanding
SA-BPMS-2012-01	BPMS Effectiveness Review against N286-05 Requirements and Understanding
SA-ERI-2012-04	Assessing Life Cycle Management Plan Effectiveness
SA-PI-2012-01	Root Cause Investigation - Root Cause Investigation (RCI) Success
SA-COM-2014-02	Obsolescence Management
SA-BPMS-2014-01	Compliance with CSA N286-05
SA-ERI-2013-01	Component Programs
SA-ERI-2013-02	Engineering Program
SA-ERI-2013-03	System and Component Performance Monitoring Program Compliance
SA-ERI-2013-04	System Engineering Effectiveness
SA-ERI-2013-05	Equipment Reliability Performance Review Meeting
SA-ERI-2013-06	Buried Piping Program

FASA Number	FASA Title
SA-ERI-2013-07	Station Engineering Training FASA
SA-ERI-2013-08	PM Program
SA-ERI-2013-08	Effectiveness of ERCOE Implementation
SA-ERI-2013-09	Fuel Handling Software Procedure Updates
SA-ERI-2013-10	Plant Engineering Evaluations
SA-ERI-2013-11	Benefits Realization for Ventyx ER Suite (formerly IKS)
SA-ERI-2014-01	Review of Data Needs to Assess SSC Aging
SA-ERI-2014-02	Asset Management Program Effectiveness
SA-ERI-2014-03	Aggregate Risk Review
SA-ERI-2014-05	ER Interface with PB Program, JUN 302014
SA-ERI-2014-06	Heat Exchanger Program
SA-ERI-2014-07	Quality of System Health Reporting
SA-ERI-2014-08	Effectiveness of deployment of SmartSignal at BA and BB
SA-ERI-2014-09	Ice Plugging - Resources and Applications
SA-MPR-2014-08	Equipment Capability
SA-PI-2014-01	Serious and systemic problems as per CSA 286-05 clause 5.11 (5.11 Problems are identified and resolved)
SA-WMSI-2014-02	Seasonal Readiness

E.2. Audits

Audit Serial#	Title
AU-2010-00019	Restart Maintenance and Maintenance Programs
AU-2010-00031	N286-05 Implementation
AU-2010-00032	Fuel Handling - Bruce B SIFB Activities
AU-2010-00036	Pressure Boundary Quality Assurance Program
AU-2010-00037	Bruce A RV Field Repairs
AU-2010-00038	PBQAP Section 18 Audit

Audit Serial#	Title
AU-2010-00039	SLAR Trolley Rehab Project
AU-2011-00002	Chemistry and Environment
AU-2011-00003	Pressure Boundary Quality Assurance Program
AU-2011-00004	Available for Restart
AU-2011-00007	RV Field Repairs
AU-2011-00016	Environmental Qualification
AU-2011-00017	SST Scheduling and Completion
AU-2011-00018	Steam Generator Life Cycle Management
AU-2011-00019	Summer Readiness
AU-2011-00021	Pressure Boundary Quality Assurance Program Section 18
AU-2011-00024	Chemistry Program
AU-2011-00025	PM Deferrals
AU-2011-00027	Foreign Material Exclusion
AU-2011-00028	Performance and Condition Monitoring
AU-2012-00001	Pressure Boundary Quality Assurance Program Section 18
AU-2012-00002	Pressure Boundary Quality Assurance Program
AU-2012-00006	Equipment Reliability
AU-2012-00016	Procurement Engineering
AU-2013-00001	Pressure Boundary Quality Assurance Program Section 18
AU-2013-00002	Pressure Boundary Quality Assurance Program
AU-2013-00005	RV Field Repairs
AU-2013-00006	Maintenance
AU-2013-00007	Bruce Power Management System
AU-2013-00008	Outage Management
AU-2013-00010	Nuclear Fuel Management
AU-2013-00018	Fluid Leak Management Program

E.3. CNSC Inspections

Doc #[40]	Title
-07274	AL 090736: ADDRESS BA CLASS III POWER INSPECTION: BRPD-2009-A-039
-07647	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD- 2009-A-060 INSPECTION OF THE POSITIVE PRESSURE TEST OF CONTAINMENT
-07664	BRUCE A - CNSC TYPE II INSPECTION ON THE IMPLEMENTATION OF PERIODIC INSPECTION PROGRAMS (PIPS) FOR CSA N285.4 AND CSA N285.5
-07665	QUARTERLY FIELD SURVEILLANCE INSPECTIONS FOR BRUCE A AND B
-07678	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRUCE A VACUUM BUILDING OUTAGE RADIATION SAFETY WALKDOWN OF UNIT 3 BRPD-2009-A-061
-07690	TYPE II INSPECTION - IDB-2008-A-029 BRUCE A - MAINTENANCE WALKDOWN INSPECTION AND WORK MANAGEMENT
-07731	BRUCE A AND B CNSC TYPE I COMPLIANCE INSPECTION REPORT #BRPD-2009-AB-009 WORK MANAGEMENT ACTIVITIES RELATED TO MAINTENANCE
-07756	BRUCE A CNSC TYPE II COMPLIANCE INSPECTION REPORT BRPD-2009-A-063 VACUUM BUILDING OUTAGE, REVIEW OF THE UNIT 3 OUTAGE HEAT SINKS
-07764	QUARTERLY SUMMARY INSPECTION REPORT FOR THE COMPLETED FIELD SURVEILLANCE INSPECTIONS FOR BRUCE A AND B
-07837	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD- 2010-A-012 BRUCE A 2009 VACUUM BUILDING OUTAGE AND UNITS 3 AND 4 OUTAGE EVALUATION
-07861	ACTION ITEMS AI 050709 AND AI 051407: FOLLOW-UP TO TYPE 1 INSPECTION OF RELIABILITY DATA COLLECTION AND TREATMENT AT BRUCE A AND B NGS
-07869	BRUCE A: INSPECTION OF THE POSITIVE PRESSURE TEST OF CONTAINMENT 2009 - BRPD-2009-A-060
-07893	BRUCE A: CNSC COMPLIANCE INSPECTION REPORT VACUUM BUILDING OUTAGE RADIATION SAFETY WALKDOWN OF UNIT 3 BRPD-2009-A-061
-07902	QUARTERLY FIELD SURVEILLANCE INSPECTIONS FOR BRUCE A AND BRUCE B

[40] All Document numbers preceded by NK21-CORR-00531-

Doc #[40]	Title
-07952	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2009-A-054 BRUCE A 2009 NEGATIVE PRESSURE CONTAINMENT SYSTEM INSPECTION
-07961	BRUCE A AND B CNSC COMPLIANCE INSPECTION REPORT BRPD-2010-AB-003 CONTROL EQUIPMENT ROOM CENTRAL DISTRIBUTION FRAME AGEING
-07972	AI 100700: BRUCE A AND B CNSC TYPE I COMPLIANCE INSPECTION REPORT BRPD-2009-AB-009 WORK MANAGEMENT ACTIVITIES RELATED TO MAINTENANCE
-07979	BRPD-2010-AB-001, BRUCE A AND B GENERATING STATIONS FOURTH QUARTER RESULTS FROM CNSC FIELD SURVEILLANCE INSPECTIONS
-07996	ACTION ITEM 100709: BRUCE A 2009 NEGATIVE PRESSURE CONTAINMENT SYSTEM INSPECTION - BRPD-2009-A-054
-08001	BRUCE A UNIT 1/2 CNSC TYPE II INSPECTION REPORT - BRUCE A UNIT 1/2 RESTART SDS1 COMMISSIONING REVIEW BRPD-2010-R-006
-08048	ACTION ITEM 100710: BRUCE A AND B CNSC COMPLIANCE INSPECTION REPORT BRPD-2010-AB-003 CONTROL EQUIPMENT ROOM CENTRAL DISTRIBUTION FRAME AGEING
-08117	ACTION ITEM 100709: BRUCE A 2009 NEGATIVE PRESSURE CONTAINMENT SYSTEM INSPECTION - BRPD-2009-A-054
-08118	ACTION 100710: BRUCE A AND B CNSC COMPLIANCE INSPECTION REPORT BRPD-2010-AB-003 CONTROL EQUIPMENT ROOM CENTRAL DISTRIBUTION FRAME AGEING
-08156	FIRST QUARTER 2010 FIELD INSPECTIONS FOR BRUCE A AND B BRPD-2010-AB-005
-08157	ACTION ITEM 100713: CNSC COMPLIANCE INSPECTION REPORT BRPD-2010-AB-004 CONFIGURATION MANAGEMENT
-08185	CNSC COMPLIANCE INSPECTION REPORT FOR THE IMPLEMENTATION OF THE N285.4 AND N285.5 PERIODIC INSPECTION PROGRAMS AT BRUCE A BRPD-2010-A-008
-08201	TYPE II INSPECTION ON THE IMPLEMENTATION OF THE BRUCE A CSA N287.7 PERIODIC INSPECTION PROGRAMS (PIPS) FOR CONCRETE CONTAINMENT STRUCTURE.....
-08217	ACTION ITEM 100713: RESPONSE TO CNSC COMPLIANCE INSPECTION REPORT BRPD-2010-AB-004 CONFIGURATION MANAGEMENT
-08248	CNSC STAFF REVIEW OF THE BRUCE POWER RESPONSE TO WORK MANAGEMENT REPORT BRPD-2009-AB-009

Doc #[40]	Title
-08286	ACTION ITEM 100700: CNSC STAFF REVIEW OF THE BRUCE POWER RESPONSE TO WORK MANAGEMENT REPORT BRPD-2009-AB-009
-08297	BRUCE A TYPE II INSPECTION REPORT MMCC BINDER INSPECTION REPORT BRPD-2010-R-014
-08298	BRUCE A UNITS 1 AND 2 RETURN TO SERVICE: INTEGRATED IMPLEMENTATION PLAN COMPLETION INSPECTION BRPD-2010-R-012
-08372	AI 100700: BRUCE A AND B CNSC TYPE I COMPLIANCE INSPECTION REPORT BRPD-2009-AB-009 WORK MANAGEMENT ACTIVITIES RELATED TO MAINTENANCE
-08404	BRUCE A TYPE II COMPLIANCE INSPECTION BRPD-2010-A-034 - ECI SYSTEM INSPECTION UNITS A0/3
-08407	QUARTERLY FIELD INSPECTIONS FOR BRUCE A AND B BRPD-2010-AB-012
-08429	BRUCE A UNITS 1 AND 2 RETURN TO SERVICE: CNSC COMPLIANCE INSPECTION REPORT-SYSTEM COMMISSIONING CATEGORIZATION INSPECTION BRPD-2010-R-017
-08430	BRUCE A UNIT 1/2 CNSC TYPE II INSPECTION REPORT - BRUCE A UNIT 1/2 RESTART SDS2 COMMISSIONING REVIEW BRPD-2010-R-021
-08481	BRUCE A UNITS 1 & 2 RETURN TO SERVICE: TYPE 2 COMPLIANCE INSPECTION REPORT - BRPD-2010-R-019 FOLLOW UP ON ACTION FROM BRUCE POWER AUDIT AU-2010-00017
-08498	ACTION ITEM 110700: BRUCE A ECI SYSTEM INSPECTION UNITS 0/3 - BRPD-2010-A-034
-08537	QUARTERLY FIELD INSPECTIONS FOR BRUCE A AND B BRPD-2010-AB-014
-08587	BRUCE A UNITS 1 & 2 RETURN TO SERVICE: OPERATING AND MAINTENANCE DOCUMENTATION UPDATE INSPECTION BRPD-2011-R-005
-08612	ACTION ITEM 110700: BRUCE A ECI SYSTEM INSPECTION - BRPD-2010-A-034
-08613	BRUCE A TYPE II INSPECTION REPORT MMCC BINDER INSPECTION REPORT - BRPD-2011-R-007
-08626	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-015 POWERHOUSE EMERGENCY VENTILATION SYSTEM INSPECTION
-08656	ACTION ITEM 100713 - CNSC COMPLIANCE INSPECTION REPORT BRPD-2010-AB-004 CONFIGURATION MANAGEMENT
-08668	CNSC TYPE II INSPECTION NOTIFICATION - SOFTWARE MAINTENANCE AND CONFIGURATION MANAGEMENT

Doc #[40]	Title
-08676	BRUCE A TYPE II INSPECTION REPORT - MMCC BINDER INSPECTION REPORT - BRPD-2011-R-011
-08678	ACTION ITEM 110722: TYPE II COMPLIANCE INSPECTION REPORT - BRUCE A CLASS III POWER SYSTEM INSPECTION BRPD-2011-R-003
-08679	BRUCE A AND B CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-AB-003 MAINTENANCE PLAN AND SCHEDULE INSPECTION ACTION ITEM 110721
-08682	BRUCE A AND B TYPE II COMPLIANCE INSPECTION - BRUCE N285.0 PRESSURE BOUNDARY PROGRAM AND AIA AGREEMENT - BRPD-2011-AB-009
-08703	BRUCE A CNSC COMPLIANCE INSPECTION REPORT CHEMISTRY CONTROL BRPD-2011-A-025
-08749	FOURTH QUARTER FIELD SURVEILLANCE INSPECTION FOR BRUCE A AND B BRPD-2011-AB-006
-08750	BRUCE A UNITS 1&2 RETURN TO SERVICE INTEGRATED IMPLEMENTATION PLAN FUEL LOAD COMMITMENTS INSPECTION BRPD-2011-R-004
-08777	ACTION ITEM 1107-2176: BRUCE A UNITS 1&2 RESTART: MMCC BINDER INSPECTION REPORT - BRPD-2011-R-017
-08796	ACTION ITEM 100713: CNSC COMPLIANCE INSPECTION REPORT BRPD-2010-AB-004 CONFIGURATION MANAGEMENT
-08807	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-006 SERVICE WATER SYSTEM INSPECTION, UNIT 0A AND 3 ACTION ITEM 1107-2184
-08808	ACTION ITEM 1107-2182 - BRUCE A UNITS 1 AND 2 RESTART BRPD-2011-R-012 - AVAILABLE FOR RESTART INSPECTION FUEL LOAD SYSTEMS
-08813	ACTION ITEM 110721: BRUCE A AND B CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-AB-003 MAINTENANCE PLAN AND SCHEDULE INSPECTION
-08847	ACTION ITEM 1107-2182 BRUCE A UNITS 1 AND 2 RESTART: BRPD-2011-R-012 - AVAILABLE FOR RESTART INSPECTION FUEL LOAD SYSTEMS
-08873	ACTION ITEM 1107-2184: BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-006 SERVICE WATER SYSTEM INSPECTION, UNIT 0A AND 3
-08956	QUARTERLY FIELD INSPECTIONS FOR BRUCE A AND B BRPD-2011-AB-012
-09004	ACTION ITEM 1107-2182: BRUCE A UNITS 1 AND 2 RESTART: BRPD-2011-R-R-012 - AVAILABLE FOR RESTART INSPECTION FUEL LOAD SYSTEMS

Doc #[40]	Title
-09010	BRUCE A UNITS 1 AND 2 RESTART: BRPD-2011-R-028 UNIT 1 MODERATOR FILL MILESTONE INSPECTION
-09016	ACTION ITEM 110722: TYPE II COMPLIANCE INSPECTION REPORT - BRUCE A CLASS III POWER SYSTEM INSPECTION BRPD-2011-R-003
-09030	ACTION ITEM 1107-2184: BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-006 SERVICE WATER SYSTEM INSPECTION, UNIT 0A AND 3
-09036	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-R-032 UNIT 2 VAULT PRESSURE TEST
-09061	AI 100700: BRUCE A AND B CNSC TYPE 1 COMPLIANCE INSPECTION REPORT BRPD-2009-AB-009 WORK MANAGEMENT ACTIVITIES RELATED TO MAINTENANCE
-09063	ACTION ITEM 110722: TYPE II COMPLIANCE INSPECTION REPORT - BRUCE A CLASS III POWER SYSTEM INSPECTION BRPD-2011-R-003
-09065	ACTION ITEM 1107-2184: BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-006 SERVICE WATER SYSTEM INSPECTION, UNIT 0A AND 3
-09069	BRUCE A & B - CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-AB-010 SOFTWARE CONFIGURATION MANAGEMENT INSPECTION ACTION ITEM 1107-2761
-09077	ACTION ITEM 100713: CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-AB-004 CONFIGURATION MANAGEMENT
-09107	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-R-036 WALK DOWN OF IIP POST-LOCA MITIGATION MODIFICATIONS
-09114	BRUCE A RESTART - CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-R-033 UNIT 2 REACTOR VAULT HOUSEKEEPING
-09149	BRUCE A MMCC BINDER INSPECTION REPORT - BRPD-2011-R-041
-09154	ACTION ITEM 1107-2820: BRUCE A UNIT 1 RETURN TO SERVICE: AVAILABLE FOR RESTART INSPECTIONS-FUEL LOAD SYSTEMS-BRPD-2011-R-031
-09155	BRUCE A UNIT 1 RETURN TO SERVICE: COMMISSIONING INSPECTION FOR FUEL LOAD - BRPD-2011-R-040
-09156	CNSC TYPE II COMPLIANCE INSPECTION - CONTROL MAINTENANCE TRAINING AT BRUCE POWER
-09181	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-047, VERIFICATION OF REACTOR SHUTDOWN GUARANTEES

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-09182	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-013 LIQUID ZONE CONTROL SYSTEM INSPECTION
-09184	BRUCE A AND B GENERATING STATIONS QUARTERLY FIELD INSPECTION REPORT BRPD-2011-AB-015 - ACTION ITEM 1107-2949
-09192	ACTION ITEM 1107-2761: BRUCE A & B BRPD-2011-AB-010 SOFTWARE CONFIGURATION MANAGEMENT INSPECTION REPORT
-09199	BRUCE A UNITS 1 & 2 RESTART: COMMISSIONING INSPECTION FOR FUEL LOAD - BRPD-2011-R-013
-09203	BRUCE A QUALIFIED POWER SUPPLY SYSTEM INSPECTION CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-R-043 ACTION ITEM 1207-2993
-09215	BRUCE A UNITS 1 AND 2 RETURN TO SERVICE - IIP COMPLETION INSPECTION - RELEASE OF REACTOR SHUTDOWN GUARANTEES - BRPD-2011-R-039
-09235	BRUCE POWER RESPONSES TO THE CNSC INSPECTION REPORT BRPD-2010-B-046
-09241	BRUCE A UNITS 1 & 2 RETURN TO SERVICE: MMCC BINDER INSPECTION BRPD-2011-R-046
-09256	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-A-2012-005, VERIFICATION OF OUTAGE HEAT SINK LINE-UP
-09257	CNSC REVIEW OF BRUCE POWER RESPONSE TO BRPD-2010-B-046
-09263	ACTION ITEM 1107-2949: RESPONSE TO THE ACTION NOTICES & RECOMMENDATIONS OF REPORT #BRPD-2011-AB-015
-09267	BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT BRPD-2011-AB-019
-09285	ACTION ITEM 1207-2993: BRUCE A QUALIFIED POWER SUPPLY SYSTEM INSPECTION CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-R-043
-09289	BRUCE A UNITS 1 AND 2 RETURN TO SERVICE - IIP COMPLETION INSPECTION - RELEASE OF REACTOR SHUTDOWN GUARANTEES, PART B:BRPD-R-2012-004
-09298	BRUCE A UNITS 1 AND 2 RETURN TO SERVICE: OPEN ITEM COMPLETION INSPECTION - BRPD-R-2012-002
-09337	CNSC TYPE II COMPLIANCE INSPECTION REPORT: AVAILABLE FOR RESTART INSPECTION, REPORT #BRPD-R-2012-005 - BRUCE A, UNITS 1 AND 2

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-09338	CNSC TYPE II COMPLIANCE INSPECTION REPORT - PHTS HYDROSTATIC PRESSURE TEST INSPECTION, REPORT #BRPD-2-2012-008
-09355	BRUCE NGS-A-CNSC TYPE II COMPLIANCE INSPECTION REPORT-COMMISSIONING INSPECTION FOR UNIT 2 RELEASE OF REACTOR SHUTDOWN GUARANTEES (RSG) SYSTEMS...
-09356	BRUCE NGS-A-CNSC TYPE II COMPLIANCE INSPECTION REPORT-COMMISSIONING INSPECTION FOR UNIT 2 RELEASE OF REACTOR SHUTDOWN GUARANTEES (RSG) SYSTEMS...
-09365	BRUCE A UNITS 1 AND 2 RETURN TO SERVICE - IIP COMPLETION INSPECTION - RELEASE OF REACTOR SHUTDOWN GUARANTEES, PART C:BRPD-R-2012-009
-09366	BRUCE A UNIT 2 RESTART CNSC MMCC BINDER INSPECTION REPORT BRPD-R-2012-010
-09373	ACTION ITEM 1107-2820: BRUCE A UNIT 1 RETURN TO SERVICE: BRPD-2011-R-031 - AVAILABLE FOR RESTART INSPECTION FUEL LOAD SYSTEMS
-09401	BRUCE A AND B CNSC COMPLIANCE INSPECTION REPORT BRPD-AB-2012-002 MAINTENANCE PLAN AND SCHEDULE INSPECTION - ACTION ITEM 1207-3218
-09422	ACTION ITEM 1107-2820: BRUCE A UNIT 1 RETURN TO SERVICE: BRPD-2011-R-031 - AVAILABLE FOR RESTART INSPECTION FUEL LOAD SYSTEMS
-09425	BRUCE A AND OUTSIDE BRUCE POWER CNSC COMPLIANCE INSPECTION REPORT BRPD-A-2012-013 ENVIRONMENTAL MONITORING BRUCE A AND OUTSIDE BRUCE POWER....
-09442	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-A-2012-015 MAINTENANCE INSPECTION WORK EXECUTION OF NMS CREW
-09443	BRUCE A UNIT 2 CNSC APPROACH TO CRITICAL AND LOW POWER PHYSICS TEST REPORT BRPD-R-2012-014
-09466	BRUCE A UNITS 1 AND 2 RETURN TO SERVICE: CNSC COMPLIANCE INSPECTION REPORT BRPD-R-2012-013 UNIT 1 VAULT PRESSURE TEST
-09481	ACTION ITEM 1107-2184: BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-006 SERVICE WATER SYSTEM INSPECTION, UNIT 0A AND 3
-09485	BRUCE A UNIT 2 AFR INSPECTION - PRIMARY HEAT TRANSPORT PLC COMMISSIONING BRPD-R-2012-017 ACTION ITEM 1207-3268

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-09503	BRUCE POWER RESPONSE TO THE BRUCE A AND B CNSC COMPLIANCE INSPECTION REPORT BRPD-AB-2012-02 MAINTENANCE PLAN AND SCHEDULE INSPECTION ACTION ITEM 1207-3218
-09520	CLOSURE OF AI 100700: BRUCE A AND B CNSC TYPE 1 COMPLIANCE INSPECTION REPORT BRPD-2009-AB-009 WORK MANAGEMENT ACTIVITIES RELATED TO MAINTENANCE
-09532	ACTION ITEM 1107-2184: BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-006 SERVICE WATER INSPECTION, UNIT 0A AND 3
-09539	ACTION ITEM 1207-3289: BRUCE A UNIT 2 RETURN TO SERVICE: CNSC INSPECTION OF SAFETY SYSTEM TEST 2.18 - BRPD-R-2012-019
-09545	BRUCE A UNIT 2 AFR INSPECTION - PRIMARY HEAT TRANSPORT PLC COMMISSIONING BRPD-R-2012-017- ACTION ITEM 1207-3268
-09563	ACTION ITEM 1207-3218: BRUCE A AND B CNSC COMPLIANCE INSPECTION REPORT: BRPD-AB-2012-002 MAINTENANCE PLAN AND SCHEDULE INSPECTION
-09564	BRPD-AB-2012-006 CONTROL MAINTENANCE TRAINING PROGRAM TYPE II
-09565	BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT BRPD-AB-2012-005
-09582	ACTION ITEM 1107-2949:CNSC RESPONSE TO BRUCE POWER CONCERNING THE BRUCE A AND B GENERATING STATIONS QUARTERLY INSPECTION REPORT BRPD-2011-AB-015
-09585	BRUCE A UNIT 2 RETURN TO SERVICE IIP COMPLETION INSPECTION - 50% REACTOR POWER HOLD POINT - BRPD-R-2012-020
-09628	ACTION ITEM 1207-3289: BRUCE A UNIT 2 RETURN TO SERVICE: CNSC INSPECTION OF SAFETY SYSTEM TEST 2.18 - BRPD-R-2012-019
-09635	CNSC TYPE II COMPLIANCE INSPECTION - ENVIRONMENTAL QUALIFICATIONS PROGRAM AT BRUCE POWER UNITS 1 AND 2
-09659	BRPD-R-2012-024: BRUCE A UNIT 1 WALKDOWN OF IIP POST-LOCA MITIGATION MODIFICATIONS
-09669	BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-A-2012-017 INSTRUMENT AIR UNIT 4 SYSTEM INSPECTION
-09670	BRUCE A UNIT 2 RESTART CNSC MMCC BINDER INSPECTION REPORT BRPD-R-2012-025
-09707	BRUCE A UNIT 1 RETURN TO SERVICE: PRIMARY HEAT TRANSPORT HYDROSTATIC PRESSURE TEST INSPECTION BRPD-R-2012-031

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-09733	BRPD-R-2012-026, TYPE II COMPLIANCE INSPECTION REPORT: BRUCE A GENERATING STATION UNIT 1, SDS1 ION CHAMBER AMPLIFIER RESPONSE TIME
-09735	ACTION ITEM 1207-3286: BRUCE A UNIT 2 RETURN TO SERVICE: CNSC INSPECTION OF SAFETY SYSTEM TEST 2.18 - BRPD-R-2012-019
-09744	ACTION ITEM 1207-2993 & BRPD-2011-R-043-AN-001: BRUCE A QUALIFIED POWER SUPPLY SYSTEM
-09793	TYPE II COMPLIANCE INSPECTION REPORT: BRUCE A UNIT1 RETURN TO SERVICE: APPROACH TO CRITICAL AND SHUTDOWN SYSTEM RUNDOWN TESTS, REPORT #BRPD-R-2012
-09806	BRUCE A - CNSC TYPE II COMPLIANCE INSPECTION REPORT: UNIT 1 VAULT CLOSE-OUT INSPECTION, REPORT #BRPD-R-2012-035
-09821	ACTION ITEM 1107-2184: BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-006 SERVICE WATER INSPECTION, UNIT 0A AND 3
-09825	CNSC TYPE II INSPECTION FOR PRESSURE BOUNDARY PROGRAM COMPLIANCE
-09826	BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q1 BRPD-AB-2012-008 ACTION ITEM 1207-3510
-09833	BRUCE A AND BRUCE B CNSC COMPLIANCE INSPECTION REPORT BRPD-AB-2012-009-RADIOLOGICAL HAZARD CONTROL ACTION ITEM 1207-3516
-09851	ACTION ITEM 1207-3516: RESPONSE TO BRUCE A AND BRUCE B CNSC COMPLIANCE INSPECTION REPORT BRPD- 2012-009, RADIOLOGICAL HAZARD CONTROL
-09895	ACTION ITEM 1107-2184: BRUCE A CNSC COMPLIANCE INSPECTION BRPD-2011-A-006 - SERVICE WATER SYSTEM INSPECTION, UNIT 0A AND 3
-09993	ACTION ITEM 050709 AND 051407: FOLLOW-UP ON TYPE 1INSPECTION OF RELIABILITY DATA COLLECTION AND TREATMENT AT BRUCE A AND B NGS
-10020	CLOSURE OF ACTION ITEM 1107-2949: CONCERNING THE BRUCE A AND B GENERATING STATIONS QUARTERLY INSPECTION REPORT BRPD-2011-AB-015
-10029	ACTION ITEM 1207-2993: BRUCE A QUALIFIED POWER SUPPLY (QPS) SYSTEM - CNSC COMPLIANCE INSPECTION REPORT ACTION NOTICE BRPD-2011-R-043-AN-0001
-10041	ACTION ITEM 1107-2761 ACTION NOTICE BRPD-2011-AB-010-AN05 - FUEL HANDLING (FH) OPDATA QUALIFICATIONS

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-10055	ACTION ITEM 1107-2761: SOFTWARE CONFIGURATION MANAGEMENT INSPECTION RECOMMENDATION BRPD-2011- AB-010-R01
-10076	BRUCE B CNSC COMPLIANCE INSPECTION REPORT BRPD-AB-2012-011 - PRESSURE BOUNDARY PROGRAM COMPLIANCE AT BRUCE POWER
-10080	BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q2, BRPD-AB-2012-014
-10107	CNSC TYPE II COMPLIANCE INSPECTION REPORT, UNIT 3 WEST SHIFT PLUS (A1133) OUTAGE INSPECTION, REPORT BRPD-A-2012-019-NEW ACTION ITEM 1207-3884
-10108	ACTION ITEM 1107-2761: ACTION NOTICE BRPD-2011-AB-010-AN03 - FUEL HANDLING SOFTWARE PROCEDURE UPDATE
-10124	ACTION ITEM 1107-2761: BRUCE A & B BRPD-2011-AB-010 UPDATE ON ACTION NOTICES AN01 & AN02
-10160	ACTION ITEMS 050709 AND 051407: FOLLOW-UP TO TYPE 1 INSPECTION OF RELIABILITY DATA COLLECTION AND TREATMENT AT BRUCE A AND B
-10226	ACTION ITEM 1207-3510: CNSC COMPLIANCE INSPECTION REPORT BRPD-AB-2012-008 BRUCE A AND B QUARTERLY INSPECTION REPORT FOR Q1
-10247	BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q3, BRPD-AB-2012-017
-10331	BRUCE A CNSC TYPE II COMPLIANCE INSPECTION REPORT: BRPD-A-2013-001-CHEMISTRY COMPLIANCE INSPECTION
-10365	FOLLOW-UP ON TYPE 1 INSPECTION OF RELIABILITY DATA COLLECTION AND TREATMENT AT BRUCE A AND B NGS - ACTION ITEM 050709 AND 051407
-10376	ACTION ITEM 1207- 3884: RESPONSE TO REPORT NO. BRPD-A-2012-019
-10401	BRUCE A CNSC TYPE II COMPLIANCE INSPECTION REPORT:BRPD-A-2013-003 - CLASS I AND II POWER SYSTEM
-10474	ACTION ITEM 1107-2184: BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-006 SERVICE WATER INSPECTION, UNIT 0A AND 3
-10486	ACTION ITEM 1207-2993: BRUCE A QUALIFIED POWER SUPPLY (QPS) SYSTEM - CNSC COMPLIANCE INSPECTION REPORT ACTION NOTICE BRPD-2011-R-043-AN-0001
-10494	BRUCE A CNSC TYPE II COMPLIANCE INSPECTION REPORT BRPD-A-2013-005-WORK EXECUTION BRUCE A MECHANICAL MAINTENANCE VALVE CREW (MCAV)

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-10509	TYPE II COMPLIANCE INSPECTION BRPD-A-2013-006 ACTION ITEM 1307-4044: BRUCE A UNITS 1 & 2: DEPOSITS ON FUEL BUNDLES - NEW AI 1307-4100
-10535	BRUCE A AND B: MAINTENANCE PLANNING AND SCHEDULING INSPECTION BRPD-AB-2013-004, NEW ACTION ITEM 1307-4113
-10539	BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q4, BRPD-AB-2013-005
-10557	BRUCE A CNSC TYPE II COMPLIANCE INSPECTION REPORT ANNULUS GAS FLOW RATES IN UNIT 1 - REPORT # BRPD-A-2013-007
-10567	ACTION ITEM 1207-3516: CNSC STAFF REVIEW OF BRUCE POWER'S RESPONSE TO BRPD-AB-2012-009
-10695	ACTION ITEM 1307-4229, PMOG INSPECTION AT BRUCE A AND B, REPORT #BRPD-AB-2013-008
-10696	AI 1307-4113: RESPONSE TO BRUCE A AND B: MAINTENANCE PLANNING AND SCHEDULING INSPECTION REPORT #BRPD-AB-2013-004
-10731	BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q1 BRPD-AB-2013-010 - ACTION ITEM 1307-4270
-10761	ACTION ITEM 050709 AND 051407: STATUS REPORT ON OUTSTANDING ACTIONS FROM TYPE 1 INSPECTION OF RELIABILITY DATA COLLECTION AND TREATMENT AT BRUCE
-10796	ACTION ITEM 1307-4298: RESTART EFFECTIVENESS INSPECTION TYPE II COMPLIANCE INSPECTION REPORT BRPD-A-2013-009
-10816	ACTION ITEMS 050709 AND 051407: STATUS REPORT ON OUTSTANDING ACTIONS FROM TYPE 1 INSPECTION OF RELIABILITY DATA COLLECTION AND TREATMENT AT BRUCE
-10817	ACTION ITEM 1107-2184: BRUCE A CNSC COMPLIANCE INSPECTION REPORT BRPD-2011-A-006 SERVICE WATER INSPECTION, UNIT 0A AND 3
-10818	BRUCE A AND B: MAINTENANCE PLANNING AND SCHEDULING INSPECTION BRPD-AB-2013-004, ACTION ITEM 1307-4113
-10856	AI 1207-3516: RESULTS OF REVIEW OF REQUIREMENTS FOR FIXED RADIATION PROTECTION INSTRUMENTATION CALIBRATION (ACTION NOTICE BRPD-2012-AB-009-AN10)
-10857	ACTION ITEM 1307-4229: RESPONSE TO PMOG INSPECTION AT BRUCE A AND BRUCE B, REPORT # BRPD-AB-2013-008

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-10861	ACTION ITEM 1207-2993: BRUCE A QUALIFIED POWER SUPPLY (QPS) SYSTEM - CNSC COMPLIANCE INSPECTION REPORT ACTION NOTICE BRPD-2011-R-043-AN-001
-10924	ACTION ITEMS AI 050709 AND AI 051407: FOLLOW-UP TO TYPE 1 INSPECTION OF RELIABILITY DATA COLLECTION AND TREATMENT AT BRUCE A AND B NGS
-10930	ACTION ITEM 1307-4270: RESPONSE TO BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q1 BRPD-AB- 2013-010
-10939	ACTION ITEM 1307-4298: BRUCE POWER RESPONSE TO RESTART EFFECTIVENESS INSPECTION TYPE II COMPLIANCE INSPECTION REPORT BRPD-A-2013-009
-10945	ACTION ITEM 1207-2993: BRUCE A QUALIFIED POWER SUPPLY (QPS) SYSTEM - CNSC COMPLIANCE INSPECTION REPORT ACTION NOTICE BRPD-2011-R-043-AN001
-10951	ACTION ITEM 1307-4113: BRUCE A AND B MAINTENANCE PLANNING AND SCHEDULING INSPECTION BRPD-AB-2013-004
-11006	ACTION ITEM 1207-3510: CNSC COMPLIANCE INSPECTION REPORT BRPD-AB-2012-008 - BRUCE A AND B QUARTERLY INSPECTION REPORT FOR Q1
-11018	BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q2 BRPD-AB-2013-015
-11054	CNSC TYPE II INSPECTION - CONDITION ASSESSMENTS [Action Item 2014-07-4687]
-11132	BRUCE A AND B: PMOG INSPECTION AT BRUCE A AND B BRPD-AB-2013-008, ACTION ITEM 1307-4229
-11141	ACTION ITEM 1207-3516: STATUS UPDATE ON REPORT BRPD-AB-2012-009
-11194	BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q3 BRPD-AB-2014-001
-11243	ACTION ITEM 1307-4270: BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q1 BRPD-AB-2013-010"
-11251	ACTION ITEM 1307-4229: BRUCE A AND B: PMOG INSPECTION AT BRUCE A AND B BRPD-AB-2013-008,
-11262	CNSC TYPE II INSPECTION - CONDITION ASSESSMENTS [Action Item 2014-07-4687]
-11267	CNSC TYPE II COMPLIANCE INSPECTION - BRUCE A ELECTRICAL POWER SYSTEMS

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-11303	CNSC TYPE II COMPLIANCE INSPECTION REPORT: BRPD-A-2014-001 WORK EXECUTION INSPECTION MMAS CREW
-11311	ACTION ITEM 1307-4270: BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q1 BRPD-AB-2013-010
-11354	BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q4 OF 2013-14 BRPD-AB-2014-003
-11380	ACTION ITEM 2014-07-4687: CNSC TYPE II INSPECTION CONDITION ASSESSMENT INSPECTION - BRPD-AB-2014-002
-11381	CNSC TYPE II COMPLIANCE INSPECTION REPORT: BPRD-AB-2014-005 FUKUSHIMA ACTION ITEM FIELD VERIFICATION
-11383	ACTION ITEM 1307-4270: BRUCE A AND BRUCE B QUARTERLY FIELD INSPECTION REPORT BRPD-AB-2013-010
-11443	ACTION ITEM 2014-07-5211: BRUCE A ELECTRICAL POWER SYSTEMS INSPECTION BRPD-A-2014-004
-11483	NOTIFICATION OF THE CNSC TYPE II COMPLIANCE INSPECTION - DEVELOPMENT, MAINTENANCE AND USE OF PROCEDURES
-11534	Action Item 2014-07-4687: Bruce Power Responses to CNSC Type II Inspection - Condition Assessment Inspection - BRPD-AB-2014-002
-11551	BRUCE A AND B QUARTERLY FIELD INSPECTION REPORT FOR Q1 OF 2014-15 BRPD-AB-2014-008
-11565	PROBABILISTIC SAFETY ASSESSMENT INSPECTION - NOTIFICATION
-11571	NOTIFICATION FOR UPCOMING S-294 INSPECTION
-11613	Bruce A and Bruce B Quarterly Operations Report - Second Quarter of 2014
-11710	Action Item 2014-07-5551: CNSC Type II Compliance Inspection Report BRPD-AB-2014-012, Probabilistic Safely Assessment Inspection
-11913	Action Item 2014-07-4687: CNSC Type II Inspection - Condition Assessment Inspection - BRPD-AB-2014-002