CMD 26-H103 - CNSC Staff Submission

Bruce B Units 7 and 8: Request to Extend Operation up to 310,000 Equivalent Full Power Hours

Classification	UNCLASSIFIED
Type of CMD	Original
CMD Number	CMD 26-H103
Reference CMD(s)	N/A
Type of CMD	Required Approval
Type of audience	Hearing in writing based solely on written submissions
Public hearing date	October 2026
Attachments	
Summary	This CMD presents CNSC staff's evaluation of the request made by Bruce Power to operate Bruce B Units 7 and 8 to a limit of 310,000 EFPH.
Actions required	CNSC staff request the Commission to render a decision on allowing the operation of Bruce B Units 7 and 8 to a limit of 310,000 EFPH.

CMD 26-H103 - Soumission du personnel de la CCSN

Bruce-B Tranches 7 et 8 : Demande de prolongation de l'exploitation jusqu'à 310 000 heures équivalentes pleine puissance

Classification	NON CLASSIFIÉ
Type du CMD	Version initiale
Numéro du CMD	CMD 26-H103
Date de signature	N/A
CMD(s) de référence	N/A
Type du CMD	Approbation requise
Type d'audience	Audience par écrit fondée uniquement sur des mémoires
Date de l'audience	Octobre 2026
Pièces jointes	
Sommaire	Le présent CMD présente l'évaluation par le personnel de la CCSN de la demande par Bruce Power d'exploiter les tranches 7 et 8 de la centrale de Bruce-B jusqu'à une limite de 310 000 HEPP.
Actions requises	Le personnel de la CCSN demande à la Commission de rendre une décision concernant l'autorisation de l'exploitation des tranches 7 et 8 de la centrale de Bruce-B jusqu'à une limite de 310 000 HEPP.

CMD 26-H103

Bruce B Units 7 and 8: Request to Extend Operation up to 310,000 Equivalent Full Power Hours

Signed by:

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Date: 2026.06.25 13:10:41 -04'00'

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Bruce B Units 7 and 8: Request to Extend Operation up to 310,000 Equivalent Full Power Hours

Canadian Nuclear Safety Commission

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Land acknowledgement

The Canadian Nuclear Safety Commission (CNSC) acknowledges that the Bruce A and B Nuclear Generating Stations (NGS) are located in the Municipality of Kincardine, on the eastern shore of Lake Huron, within Saukiing Anishnaabekiing. This is the traditional territory of the Saugeen Ojibway Nation (SON), the shared treaty and traditional territory of the Saugeen First Nation and the Chippewas of Nawash Unceded First Nation (Neyaashiinigmiing). Bruce NGS A and B are also located on traditional harvesting territories of the Métis Nation of Ontario (MNO) Region 7 and the Historic Saugeen Métis (HSM) peoples.

CNSC staff are committed to ongoing, respectful engagement with Indigenous Nations and communities, promoting open dialogue, supporting reconciliation, and working together to ensure the safe regulation of nuclear activities.

Plain language summary

Bruce Power is currently authorized to operate each reactor unit to a limit of 300,000 EFPH. As part of the licence renewal application for the current licence, Bruce Power Inc. (hereinafter Bruce Power or the licensee) submitted a technical basis and request for approval, within CMD 18-H4.1, to operate the Bruce A and B Nuclear Generating Stations (NGS) to a target operating period of 300,000 Equivalent Full Power Hours (EFPH). This extension in target operating period was requested to allow the reactor units to operate until their planned Major Component Replacement (MCR) outages. In September 2018, the Commission renewed Bruce Power's Power Reactor Operating Licence (PROL) authorizing the operation of the Bruce NGS A and B up to a maximum of 300,000 EFPH (Record of Decision).

Bruce Power is seeking Commission approval to extend operation of Units 7 and 8 to 310,000 EFPH to provide the operational flexibility to optimize the overall MCR schedule. This request to operate Units 7 and 8 to 310,000 EFPH (for each unit, not in aggregate) is in accordance with Licence Conditions (LC) G.1 and 6.1 of PROL 18.04/2028 and as further described in Sections G.1 and 6.1 of the associated Licence Conditions Handbook (LCH-PR-18.04/2028-R005).

Bruce Power is required to perform appropriate inspections of the fuel channels to monitor for all known pressure tube degradation mechanisms. CNSC staff are satisfied that existing methodologies are sufficient to perform fitness for service evaluations required to support the operation of the Bruce Units 7 and 8 pressure tubes up to 310,000 EFPH.

CNSC staff recommend that the Commission approve the licensee's request to extend operation of Units 7 and 8 to 310,000 EFPH. Appropriate provisions are in place to demonstrate

that the predicted condition of fuel channels continues to support safe operation for the requested operating period.

CNSC staff will continue to monitor Bruce Power's performance in respect to fuel channel fitness for service through compliance verification activities under LC 6.1 and LC 6.2. No modifications are required to LC 6.1 or LC 6.2. A draft revision to the compliance verification criteria in the LCH under section 6.1 is provided in Appendix C to capture the increased operating period. CNSC staff will update the Commission on fuel channel fitness for service at Bruce NGS A and B through various reporting mechanisms as may be appropriate.

Referenced documents in this CMD are available to the public upon request, subject to confidentiality considerations.

CMD Structure

This Commission Member Document (CMD) includes the following:

- An overview of the matter being presented
- Overall conclusions and overall recommendations
- Discussion of regulatory considerations
- Discussion of technical considerations
- Appendices material that complements the above items
- Draft change to the licence conditions handbook in section 6.1

1 Overview

The purpose of this Commission Member Document (CMD) is to provide CNSC staff's assessment and recommendations arising from the review of Bruce Power's September 26, 2025 request to operate Bruce B Units 7 and 8 (the "Request") up to 310,000 EFPH. In accordance with the Commission decision in 2018, Bruce Power is currently authorized to operate Bruce NGS A and B up to a maximum of 300,000 EFPH.

1.1 Background

Bruce Power Inc. is the licence holder and operator of the Bruce NGS A and B which consist of 8 CANDU reactor units. Bruce A NGS contains reactor units 1-4 and Bruce B NGS contains reactor units 5-8. This request is limited to units 7 and 8 because these are the only units projected to exceed 300,000 EFPH prior to reaching their Major Component Replacement (MCR) outages.

Bruce NGS A and B are situated on the shores of Lake Huron in the Municipality of Kincardine in Bruce County, Ontario. The stations are operated by Bruce Power under a lease agreement with the owner, Ontario Power Generation (OPG).

Figure 1. Bruce B Nuclear Generating Station (Image Courtesy of Bruce Power).

1.2 Highlights

During the construction of CANDU reactors, pressure tubes were designed and assembled to satisfy functional and economic life requirements for at least the equivalent of 210,000 EFPH of operation, which is roughly equivalent to 30 years of operation at a capacity factor of 80 percent. The term “effective full power hours” is sometimes used interchangeably with the same intended meaning as the “equivalent full power hours”. The original target of 210,000 EFPH was an operational target and not a safety limit; nuclear power plant operators must continue to meet the safety requirements set by the design standards irrespective of the operational target. To operate beyond the operational target of 210,000 EFPH, nuclear power plant (NPP) licensees have been required to provide sufficient evidence to demonstrate that the predicted condition of pressure tubes continues to be sufficient to meet safety requirements. Other station systems and components have their own associated requirements to demonstrate continued fitness for service.

In July 2014, Bruce Power submitted a technical basis and requested operation of Bruce NGS A and B up to a new target operating period of 247,000 EFPH (1). The Commission granted this request for Units 5 and 6 in September 2014 and for the remaining units during the 2015 licence renewal decision. Furthermore, in 2017, Bruce Power submitted a technical basis and request for approval to operate the Bruce A and B Nuclear Generating Stations (NGS) to a target operating period of 300,000 EFPH (CMD 18-H4.1). This extension in target operating period represented the maximum operational time expected for the units before they entered their respective Major Component Replacement (MCR) outages, during which the major components, including fuel channels, will be replaced. In September 2018, the Commission renewed Bruce Power’s Power Reactor Operating Licence (PROL) authorizing the operation of the Bruce NGS A and B up to a maximum of 300,000 EFPH (Record of Decision). Since 2019, NPP licensees have undertaken work to develop engineering models and methodologies for demonstrating fuel channel fitness for service to support long term operation. An overview of the progress related to pressure tube fitness for service was provided to the Commission in March of 2026 as CMD 26-M10, including a draft of revised LCH section 6.2.

In September 2025, Bruce Power submitted a request to extend the operating limit for units 7 and 8 to 310,000 EFPH to provide sufficient operational margin of projected EFPH so the units may operate to their planned MCR start dates. This licensee submission forms the basis for the matter before the Commission.

1.3 Overall Conclusions

CNSC staff have reviewed Bruce Power's request, including supporting documents, and have arrived at the following conclusions:

1. Bruce Power continues to make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.
2. Bruce Power's fuel channel fitness for service program is sufficient to support the request to extend the maximum allowable operating time of pressure tubes in Bruce Units 7 and 8 from 300,000 EFPH to 310,000 EFPH.

CNSC staff note that granting the request does not equate to an unconditional confirmation that all pressure tubes will remain fit for service until the requested operational limit of 310,000 EFPH. Bruce Power will be required to submit to CNSC staff assessments for relevant degradation mechanisms to demonstrate continued fitness for service up to 310,000 EFPH. If, at any time, an assessment indicates that compliance verification criteria cannot be satisfied for operation up to the planned refurbishment dates of the units, CNSC staff will notify the Commission and Bruce Power will be required to take appropriate actions.

1.4 Overall Recommendations

CNSC Staff recommend that the Commission authorize Bruce Power to operate Bruce B units 7 and 8 to a limit of 310,000 EFPH.

2 Environmental Assessment

An Environmental Assessment (EA) under the NSCA is not required; no new licence activities are proposed by Bruce Power and CNSC staff's recommendations include existing licensing requirements.

3 Regulatory Considerations

Licence condition 6.1 of the Bruce Power PROL (PROL 18.04/2028) states: *The licensee shall implement and maintain a fitness for service program.* The current Bruce A and B Nuclear Generating Stations Licence Conditions Handbook (LCH-PR-18.04/2028-R005) provides clarity on the associated requirements related to fuel channel fitness for service.

As indicated in the Bruce Power Design Manuals, the fuel channels were designed to meet the intent of Section III of ASME Boiler and Pressure Vessel Code. As a planning assumption, the fuel channels were designed and assembled to satisfy functional and economic life requirements for at least the equivalent of 210,000 hours of full power operation (i.e., 30 years at a capacity factor of 80%). Demonstration that fuel channels continue to meet the intent of Section III of ASME Boiler and Pressure Vessel Code is part of the design basis, which in turn is part of the licensing basis. Throughout the operating life, Bruce Power is required to provide evidence to demonstrate that the predicted condition of pressure tubes will support safe operation.

As a result of the 2018 licence renewal hearing proceedings, the Commission authorized operation of Bruce NGS A and B up to a maximum of 300,000 EFPH as stated in the Commission's Record of Decision.

Licence condition 6.2 of PROL 18.04/2028 states: *The licensee shall implement and maintain an enhanced fitness for service program for fuel channels in extended operation.*

LCH section 6.2 outlines specific compliance verification criteria related to the extended operation of pressure tubes beyond 210,000 EFPH with the potential for elevated hydrogen equivalent near the inlet and outlet rolled joint burnish marks. The enhanced fitness for service program incorporates alternate criteria to evaluate the impact of pressure tube aging on safe operation, modified reporting criteria and focused R&D activities to expand pressure tube fitness for service models to higher hydrogen equivalent concentration (Heq) limits. Heq implications are explained further in section 4 of this document.

Progress has been made with regard to these activities. CMD 26-M10, presented on March 23, 2026, provided an update of the state of pressure tube fitness for service assessments and the relevant models. CNSC staff concluded that licensees with pressure tubes in extended operation (Bruce Power and OPG) have demonstrated that an appropriate analytical toolset is available to perform the evaluations necessary to demonstrate pressure tube fitness for service under LC 6.1. This includes pressure tubes operating beyond 210,000 EFPH.

CNSC staff will continue to assess Bruce Power's pressure tube fitness for service program against the CVC for LC 6.1 and LC 6.2.

As described above, Bruce Power has requested to extend the operating life of pressure tubes several times as the ability to evaluate fitness for service has evolved. CNSC staff are of the view that there is a sufficient regulatory framework as well as a knowledge base in place to demonstrate that the assessed condition of pressure tubes continues to support safe operation, up to the requested 310,000 EFPH, while taking into account relevant degradation mechanisms.

4 Technical Considerations

The following subsections outline the technical considerations relevant to fuel channel fitness for service in extended operation. Specifically, various degradation mechanisms are discussed as they relate to the request to operate Bruce B units 7 and 8 up to 310,000 EFPH and the associated conclusions from CNSC staff review.

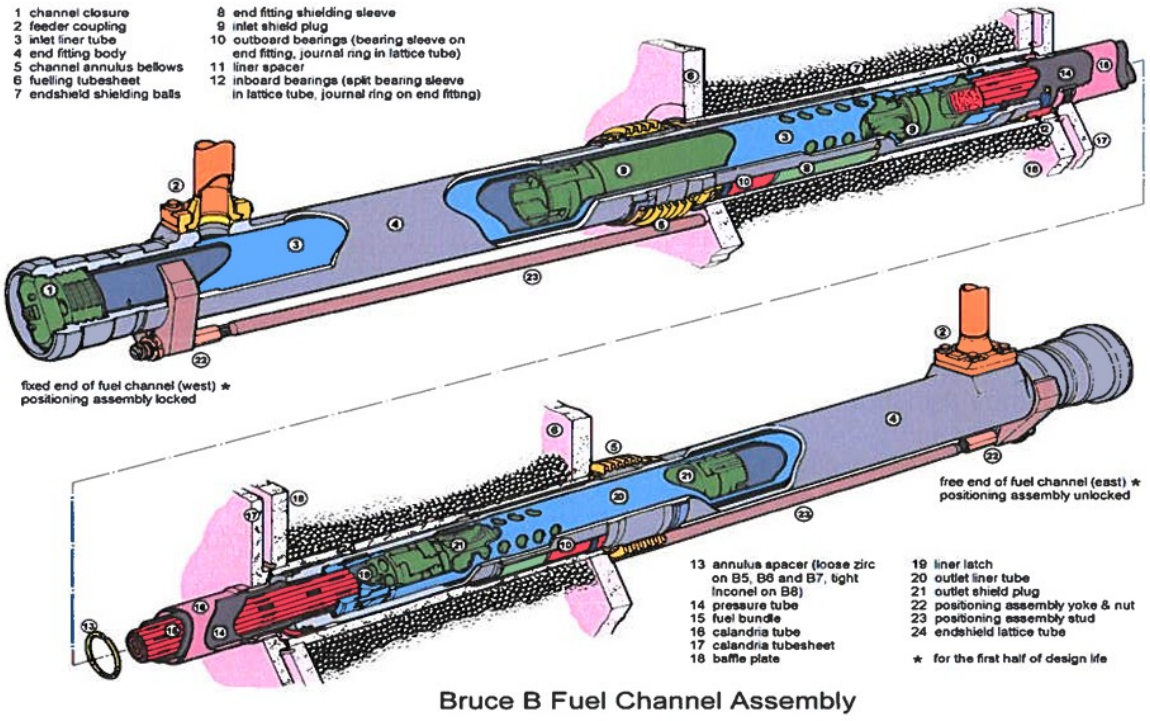

Figure 2: Bruce B Fuel Channel Assembly Diagram (Courtesy of Bruce Power)

4.1 Pressure Tube Axial Elongation

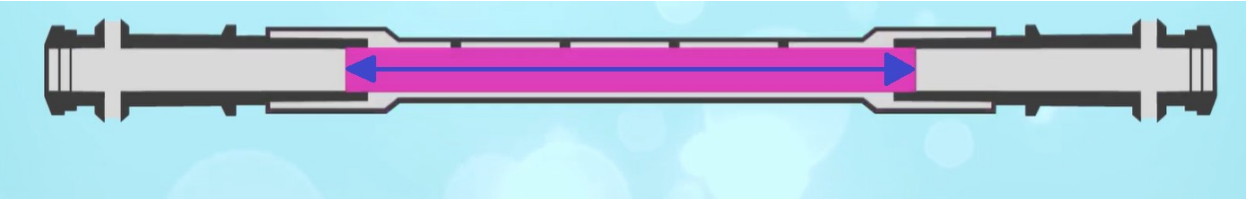

Figure 3: Simplified fuel channel diagram highlighting pressure tube elongation (Courtesy of CNSC)

CSA standard N285.4 *Periodic inspection of CANDU nuclear power plant components* requires that the fuel channels remain in an on-bearing configuration that is consistent with the design of the fuel channel. Fuel channel elongation occurs due to the normal operating condition factors such as neutron flux, operating temperature and internal pressure of the pressure tube. This causes slow material creep and very gradual axial elongation. Bruce Power currently monitors channel elongation for 100% of the reactor core during each planned unit outage. Reactor units are shut down for planned outages with a frequency of approximately two to three years to perform inspections and maintenance. When necessary, fuel channel elongation is managed through "reconfiguration", where the fixed end of the fuel channel is changed from one face of the reactor to the other to manage feeder gaps and remaining bearing travel. In addition to reconfiguration, Bruce Power may shift the fuel channel east or west on the supporting bearings to manage feeder gaps and gain bearing travel. Additionally, Bruce Power can perform selective defueling of individual channels to slow channel elongation for channels that do not have enough remaining bearing travel to reach the desired end of life operating time.

CNSC staff are satisfied that Bruce Power is performing the necessary inspections and maintenance to monitor channel elongation and has the appropriate mitigating actions in place to ensure that the fuel channels will remain in an on-bearing configuration.

4.2 Pressure Tube Wall Thinning

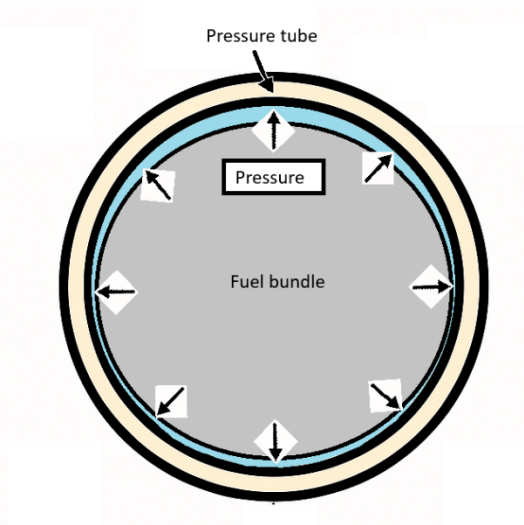

Figure 4: Simplified pressure tube cross-section (not to scale) (Courtesy of CNSC)

Pressure Tube wall thinning is monitored as part of dimensional inspections performed by Bruce Power during outages. Neutron irradiation as well as the high temperature and pressure

of the pressure tube results in slow diametral expansion and wall thinning. Bruce Power has performed consistent measurements during all recent outages, and the minimum wall thickness in Units 7 and 8 is expected to remain within the design limits.

CNSC Staff are satisfied that Bruce Power's monitoring and evaluation of pressure tube wall thinning is acceptable.

4.3 Pressure Tube Diametral Expansion

Pressure tube diametral expansion is monitored as part of dimensional inspections performed by Bruce Power during outages. Bruce Power has performed measurements of pressure tube diameter during recent Unit 7 and 8 outages. The maximum pressure tube diameter in Units 7 and 8 has been evaluated and is projected to remain within the design limits. The results of these evaluations are submitted to CNSC staff for review as required by CSA N285.4. For a sub-population of pressure tubes in Unit 8, Bruce Power has re-evaluated the design limits to support continued operation and submitted the updated registration package to the pressure boundary authority.

CNSC staff are satisfied that Bruce Power is monitoring diametral expansion as part of the dimensional inspections during outages. The number of dimensional inspections exceeds the requirements of CSA N285.4 and Bruce Power uses adequate conservatism when projecting pressure tube diametral expansion. Bruce Power is also taking appropriate measures to ensure that the pressure tube diameter remains within design limits. Bruce Power will be taking measurements during the Unit 8 2028 spring outage and is required to submit an updated assessment after this outage, as per CSA N285.4. If Bruce Power is unable to demonstrate that the inner diameter of the pressure tubes meets design requirements, mitigating action will be taken by Bruce Power for continued operation.

4.4 Pressure Tube Sag and Calandria Tube to Liquid Injection Shutdown System (LISS) Nozzle Contact

Pressure tube sag is monitored as part of dimensional inspections performed by Bruce Power during outages. Bruce Power has performed measurements during all its recent outages and will continue to take measurements during the 2027 Unit 7 and 2028 Unit 8 outages. Current assessments predict the pressure tube sag to remain within acceptable limits until well after the MCR outages for Units 7 and 8.

CSA N285.4 requires prevention of contact between calandria tubes and calandria vessel internals. Bruce Power regularly monitors the gap between calandria tubes and liquid injection

shutdown system (LISS) nozzles. The current assessments predict the earliest time for CT-LISS contact to be beyond the planned MCR dates for Units 7 and 8. If Bruce Power were to find an unexpectedly low CT-LISS nozzle gap, LISS nozzle detensioning or channel defueling can be performed to increase the gap and the predicted first time to contact.

CNSC staff are satisfied that that Bruce Power is performing adequate inspections to monitor pressure tube sag and CT-LISS nozzle contact and that Bruce Power has the necessary methodologies to assess these degradation mechanisms, and options for mitigation.

4.5 Enhanced Oxidation

Since 2018, Bruce Power has been observing areas of “enhanced oxidation” during pressure tube inspections. These regions typically have higher surface roughness resulting from the formation of thicker oxide layers on the inner diameter of the pressure tube. In some cases, these areas challenge the dimensional inspection tooling. Bruce Power has had a program in place to address inspection in areas of enhanced oxidation since 2021 and has made good progress in understanding the progression of these regions and the impact on inspection. Some techniques have been developed to allow for inspection in regions of enhanced oxidation. Bruce Power provides annual updates to CNSC staff regarding their strategy to address the pressure tube regions of oxides.

CNSC staff are satisfied that Bruce Power’s current R&D and monitoring of regions of enhanced oxidation are progressing as planned. Despite the presence of areas of enhanced oxidation, Bruce Power meets the inspection requirements of CSA N285.4. Bruce Power will continue to provide updates on the enhanced oxidation phenomena to demonstrate pressure tubes continue to meet applicable compliance verification criteria while in operation.

4.6 Deuterium Ingress and Channels Exceeding Terminal Solid Solubility of Dissolution

Deuterium ingress occurs during normal operation and hot conditions and is the primary factor for increasing hydrogen equivalent concentration (Heq) in the pressure tube material. Heq is a key input for multiple pressure tube fitness for service assessments. Increased Heq can result in blister formation at locations of pressure tube to calandria tube contact, increased probability of crack initiation and lower fracture toughness. Bruce Power currently monitors Heq through scrape campaigns and measurements from surveillance pressure tubes. These measurements have been used to develop and validate predictive models for the Body of Tube (BOT) and rolled joint (RJ) regions of the pressure tube and are compared to the CSA N285.4 Heq limits.

If Heq is predicted to exceed Terminal Solid Solubility of Dissolution (TSSD) in the body of tube, Bruce Power is required to submit a component disposition to CNSC staff for acceptance as required by CSA N285.4. CNSC staff are satisfied that there are currently no pressure tubes in Units 7 and 8 operating above the concentration of 100 ppm limit in the body of tube, which is the current limit for the Heq for these dispositions. Bruce Power has recently submitted a request to increase the limit to 120 ppm for CNSC acceptance; CNSC staff are reviewing this request.

In 2021 industry reported findings of elevated Heq in the rolled joint regions of some pressure tubes. Since that time, industry has undertaken significant research and development work to understand Heq in the rolled joint regions. The majority of the work has been completed to CNSC staff satisfaction. Industry has committed to continue R&D work to further refine models for Heq in the rolled joint regions and support continued operation of the pressure tubes. This subject was a focus area for the Heq update to the Commission in CMD 26-M10.

CNSC staff are satisfied that Bruce Power has developed the necessary tools to assess the impact of elevated Heq in the rolled joint regions to account for the findings of elevated Heq.

4.7 Fracture Toughness

Fracture toughness of pressure tubes decreases with operation and increased hydrogen concentrations at a certain range of temperatures. Fracture toughness is a key input into leak before break (LBB) assessments, fracture protection (FP) evaluations, and probabilistic evaluations of the core for flaws. Industry has developed models for assessing fracture toughness for pressure tubes and maintains an extensive burst test program to continue to develop and validate this model. Regular updates on the burst test program and fracture toughness model development are provided to CNSC staff.

With the discovery of elevated Heq in regions of the pressure tube near the rolled joints, industry undertook significant focused research and development work to increase the validity limits of the fracture toughness model for Heq and develop methodologies to assess fracture toughness.

The ability of Bruce Power to operate pressure tubes to 310,000 EFPH is dependent on the predicted Heq at 310,000 EFPH and the accepted validity limits of the fracture toughness model. Bruce Power intends to increase the validity limits of the fracture toughness model and has developed methodologies to assess fracture toughness in regions of elevated Heq. Bruce Power will be providing updated fracture toughness assessments for CNSC staff acceptance in the coming months in accordance with the requirements of CSA N285.4 and CSA N285.8

Technical requirements for in-service evaluation of zirconium alloy pressure tubes in CANDU reactors.

CNSC staff are satisfied that adequate fracture toughness of pressure tubes is demonstrated by Bruce Power and such demonstration will continue to be required if the operational limit is increased to 310,000 EFPH.

4.8 PT-CT Contact

Pressure Tube to Calandria Tube (PT-CT) contact can occur when the gap between the pressure tube and calandria tube is reduced due to creep deformation and potential movement of annulus spacers. PT-CT contact is assessed using probabilistic core assessments and channel specific methodologies when PT-CT gap measurements are available. Bruce Power minimizes the potential for PT-CT contact and the associated risk of hydride blister formation by repositioning annulus spacers using either SLAR (Spacer Location and Repositioning) for channels with loose fitting spacers or MODAR (Modal Detection and Repositioning) for channels with tight fitting spacers, or through the selective defueling of channels with low PT-CT gap.

In order to demonstrate compliance with CSA N285.4 and N285.8 up to 310,000 EFPH, Bruce Power is required to submit updated PT-CT contact assessments after the next Unit 7 and 8 outages. Existing requirements are sufficient to ensure safe operation up to 310,000 EFPH.

CNSC staff are satisfied that Bruce Power has undertaken significant work to prevent PT-CT contact and has adequate tools in place to assess and mitigate PT-CT contact up to 310,000 EFPH.

4.9 Pressure Tube Flaw Assessments

Periodic inspection of pressure tubes for flaws is a requirement of CSA N285.4. Bruce Power currently exceeds the minimum number of inspections required for pressure tube flaws and performs inspections during each maintenance outage. Flaws exceeding the acceptance standards of CSA N285.4 are dispositioned using Clause 5 of CSA N285.8, which provides the requirements for evaluation of pressure tube flaws. Bruce Power intends to select the scope of the pressure tube flaw inspections in the upcoming Unit 7 2027 fall and Unit 8 2027 spring outages to ensure requirements for pressure tube flaw assessments are met up to 310,000 EFPH.

As part of the research and development activities regarding elevated Heq, industry developed new methodologies to perform flaw assessments in the rolled joint regions with bulk Heq up to

240 ppm. CNSC staff have accepted the methodologies, with some conditions, for performing the relevant assessments. An overview of pressure tube fitness for service assessments was provided in CMD 26-M10.

CNSC staff are satisfied that Bruce Power consistently performs pressure tube flaw inspections during planned outages and has the necessary evaluation methodologies to assess pressure tube flaws.

4.10 Spacer Nip-Up

Spacer nip-up occurs when the pressure tube diametral creep causes the annulus spacer to contact the full circumference of the calandria tube. The calandria tube was not designed to withstand this type of internal load from the spacer. Bruce Power has currently assessed that there will be no spacer nip-up until at least 300,000 EFPH. Bruce Power has committed to providing an updated assessment of spacer nip-up to demonstrate that nip-up will not occur until after 310,000 EFPH. If Bruce Power cannot demonstrate that nip-up will not occur prior to 310,000 EFPH, Bruce Power will need to undertake mitigating actions such as selective defueling, or single fuel channel replacement (SFCR).

CNSC staff are satisfied that that Bruce Power has the appropriate methodology to perform spacer nip-up assessments and has the option of appropriate mitigation strategies. Prior to reaching 300,000 EFPH, Bruce Power will provide updated assessments to demonstrate that nip-up will not occur before the requested 310,000 EFPH operating limit.

4.11 Spacer Integrity

Annulus spacers maintain the gap between the pressure tube and calandria tube. To ensure that the assessments of Pressure Tube to Calandria Tube (PT-CT) contact remain valid, the integrity of the annulus spacers needs to be demonstrated. The majority of channels in unit 7 contain Zr-Nb-Cu spacers which have been shown to maintain their strength during operation and have significant margin beyond 310,000 EFPH.

All fuel channels in Unit 8 and a small number of channels in Unit 7 contain tight fitting Inconel X-750 annulus spacers. These spacers experience a reduction in material strength during operation. To demonstrate the structural integrity of the spacers during operation industry has developed the “Engineering Spacer Model”. Bruce Power has currently assessed the integrity of spacers to 285,000 EFPH and has performed sensitivity studies with increased spacer material property degradation to beyond the Unit 8 MCR. The sensitivity study has significant margin on

structural integrity. Bruce Power intends to remove a spacer in the Unit 8 outage in spring of 2028 to further validate the model and their predictions. CSA N285.4 contains specific requirements related to spacer surveillance and testing and provides ongoing assurance that spacer integrity is sufficiently addressed for continued safe operation.

CNSC staff are satisfied that Bruce Power currently has a methodology to assess the structural integrity of tight-fitting X-750 spacers in Bruce Units 7 and 8. In accordance with CSA N285.4, Bruce Power is required to submit updated assessments demonstrating spacer fitness for service for CNSC acceptance to reach the requested 310,000 EFPH operating limit.

4.12 Conclusions based on technical considerations

CNSC staff have assessed that Bruce Power's fuel channel fitness for service program is sufficient to support the request to extend the maximum allowable operating time of pressure tubes in Bruce Units 7 and 8 from 300,000 EFPH to 310,000 EFPH. Execution of this program to produce fitness for service evaluations will be required to demonstrate that pressure tubes can be safety operated until the requested operational limit of 310,000 EFPH. This is standard practice under the fitness for service program and ensures that the most current information is used in assessing safety of operation.

Bruce Power has outages scheduled in 2027 and 2028 for unit 7 and 8 respectively. These outages will allow for additional pressure tube inspection and surveillance. The information collected will be used to further support and update fitness for service assessments. If any unexpected degradation is detected, Bruce Power will be required to update the assessments and resubmit for CNSC acceptance. At a minimum, Bruce Power will be required to submit updated assessments for the following degradation mechanisms since the current assessments do not reach the requested 310,000 EFPH:

- Unit 7 and 8 fuel channel axial elongation
- Unit 8 pressure tube diametral expansion
- Unit 7 and 8 deuterium concentration
- Unit 7 and 8 Fracture toughness
- Unit 7 and 8 PT-CT contact
- Unit 7 and 8 pressure tube flaws
- Unit 7 and 8 spacer nip-up
- Unit 8 annulus spacer integrity

CNSC staff confirmed that Bruce Power is performing appropriate inspections of the fuel channels to monitor for all known pressure tube degradation mechanisms. The required methodologies are in place to perform evaluations to support the operation of the Bruce Unit 7 and 8 pressure up to 310,000 EFPH. Bruce Power will be required to continue to demonstrate that the pressure tubes remain fit for service during this extension through submissions of assessments to CNSC staff for acceptance as required by the licensing basis reflected in the LCH.

5 Consultation and Engagement

5.1 Indigenous Consultation and Engagement

The common-law duty to consult with Indigenous Nations and communities applies when the Crown contemplates actions that may adversely affect potential or established Aboriginal and/or treaty rights. The Commission ensures that all of its licensing decisions under the NSCA uphold the honour of the Crown and uphold Indigenous peoples' potential asserted or established Indigenous Aboriginal and/or treaty rights pursuant to section 35 of the *Constitution Act, 1982*. When assessing whether to recommend to the Commission that duty to consult obligations are raised, CNSC staff will consider Indigenous Nations' and communities' established or potential asserted rights in relation to the expected and/or potential impacts of this request of the Commission.

REGDOC-3.2.2, *Indigenous Engagement*, sets out requirements and guidance for proponents whose proposed projects may raise the Crown's duty to consult. While the CNSC cannot delegate its duty to consult, it can delegate procedural aspects of the consultation process to proponents, where appropriate. The information collected and measures proposed by licensee proponents to avoid, mitigate, or offset potential adverse impacts from the activity described in the licence application may be used by the Commission in meeting its consultation obligations.

5.1.1 CNSC Staff's Engagement Activities

CNSC staff are committed to building long-term relationships with Indigenous Nations and communities who have rights and interests in CNSC-regulated facilities within their traditional and/or treaty territories. The CNSC's Indigenous consultation and engagement practices include sharing information, discussing topics of interest, seeking feedback and input on CNSC processes, and providing opportunities to participate in environmental

monitoring programs, such as the CNSC's Independent Environmental Monitoring Program (IEMP). The CNSC also provides funding support, through its Participant Funding Program (PFP) and Indigenous and Stakeholder Capacity Fund, for Indigenous peoples to meaningfully participate in Commission proceedings and ongoing regulatory activities.

5.1.2 Discussion

CNSC staff conduct an analysis using Crown Indigenous Relations and Northern Affairs Canada's (CIRNAC) Aboriginal and Treaty Rights Information System (ATRIS) and other mapping tools, to identify the Indigenous Nations and communities for consultation and engagement found below. CNSC staff also routinely review existing CNSC and open-source resources including records of Indigenous Nations and communities who may have expressed interest in Bruce Power's operations in the past. Should other Indigenous Nations and communities not included in the list identify interest in the application moving forward, they will be added as appropriate.

CNSC staff identified the following Indigenous Nations and Communities who have Indigenous and/or Treaty rights in the area where Bruce Power is located:

- Saugeen Ojibway Nation (SON) which is comprised of Saugeen First Nation and the Chippewas of Nawash Unceded First Nation (Neyaashiinigmiing).

In addition, CNSC staff have identified the following Indigenous Nations and communities that have expressed interest in the Bruce Power site:

- Historic Saugeen Métis (HSM)
- Métis Nation of Ontario (Region 7)
- Chippewas of Kettle and Stony Point First Nation (CKSPFN)

Bruce NGS A and B reside on lands and waters within Saukiing Anishnaabekiing. These are the traditional lands and treaty territory of the people of the Saugeen Ojibway Nation which includes the Chippewas of Nawash and Saugeen First Nation. The lands and waters upon which Bruce NGS A and B are situated are also of interest to Métis Nation of Ontario (MNO) Region 7, Historic Saugeen Métis and the Chippewas of Kettle and Stony Point First Nation. CNSC staff have ensured a thorough engagement process so that CNSC staff can understand, and work to address, any concerns that Indigenous Nations and communities may have with respect to Bruce Power's request. The CNSC is committed to keeping the identified Indigenous Nations and communities informed of ongoing activities in their territories.

Based on the information received in Bruce Power's application reviewed to date, CNSC staff's assessment is that the request for the increase of units 7 and 8 operational limit is unlikely to raise the duty to consult. In CNSC Staff's assessment, the request to extend operations is unlikely to cause new adverse impacts to the exercise of asserted or established Aboriginal and/or treaty rights as it would not change the Bruce NGS A and B site characterization, would not result in the installation of new facilities at the site, would not change the site footprint or lead to new offsite impacts.

CNSC staff and Bruce Power have conducted engagement activities with all identified Indigenous Nations and communities to ensure they were aware of Bruce Power's request, to identify and address potential concerns and questions and encourage their participation in the Commission proceeding process.

A Notice of Public Hearing was made public on November 10, 2025, and sent directly to the identified Indigenous Nations and communities on November 12, 2025. The notice also included information on participant funding. The CNSC made available up to $50,000 through its Participant Funding Program (PFP) to support Indigenous Nations and communities and members of the public in providing value added information to the Commission through informed and topic-specific interventions. CNSC staff sent a reminder email regarding the availability of PFP support and the application deadline (January 12, 2026) on January 5, 2026.

Full details on the participant funding made available and all parties that were awarded funding are available in Section 4.2 of this CMD. The Saugeen Ojibway Nation (SON) applied for and received funding to participate in this Commission hearing.

CNSC staff offered to meet with all identified Indigenous Nations and communities to discuss the submission of the request in regular meetings under Terms of Reference (TOR) for long-term engagement arrangements with SON, HSM and MNO (Region 7).

CNSC staff discussed this request during regularly scheduled meetings with SON as per the TOR and engagement workplan. As part of the discussions and engagement, SON has raised questions regarding the deterministic and probabilistic safety analyses carried out by CNSC staff regarding the operation of the pressure tubes to beyond 300,000 effective full-power hours. CNSC staff have responded to these concerns through continued discussions in regularly scheduled meetings as per the TOR. CNSC staff also provided a presentation to the SON on October 28th 2025 relating to the pressure tube life extension and held workshop discussions for the SON Environment Office and their experts on March 9th 2026, and May 4th 2026 to better illustrate how CNSC conducts and makes determinations relating to deterministic & probabilistic safety analyses and conducts submission reviews relating to this request. This information was intended to support SON's own review of CNSC staff's CMD and Bruce Power's request.

CNSC staff met with MNO Region 7 at a semi-annual meeting on November 5th, 2025 as per the MNO and CNSC TOR for long-term engagement and Bruce Power's request for extended operation of units 7 and 8 was among the topics discussed. In addition, CNSC staff have provided updates about the amendment in monthly MNO Lands Resources and Consultations department meetings.

CNSC staff provided details about this application to HSM on November 6th, 2025 as part of the semi-annual meeting as outlined by the CNSC-HSM TOR for long-term engagement.

Chippewas of Kettle and Stony Point were notified of the PFP opportunity, and CNSC staff offered to meet to discuss the application in greater detail through meetings upon request. CNSC staff discussed the proposed increased operating period during an in-person meeting on April 28th 2026.

All the identified Indigenous Nations and communities have been encouraged to participate in the regulatory review process and in the Commission hearing through written interventions to advise the Commission directly of any concerns they may have in relation to this licence amendment application. No concerns have been raised to date by MNO, HSM, or CKSPFN with CNSC staff directly. SON have raised questions and concern regarding how different safety analyses (for example deterministic and probabilistic safety analyses) are applied by CNSC staff to the consideration of the proposed life extension of pressure tubes at the Bruce NGS B. CNSC staff and the SON environment office have been working together to answer their questions and address their concerns.

5.1.3 Licensee Engagement Activities

As the request is unlikely to result in any new adverse impact on Indigenous and/or Treaty rights, the requirements in REGDOC-3.2.2: Indigenous Engagement do not apply.

However, Bruce Power's request does include details on Bruce Power's Indigenous engagement policy and activities completed to date. The application states that Indigenous engagement is ongoing, with regular updates being provided to identified Indigenous Nations and communities since 2023. Targeted outreach has been extended by Bruce Power to the SON, HSM, and the MNO (Region 7). CNSC staff encourage Bruce Power to continue their engagement efforts and communications with all identified Nations in relation to this licence application and ongoing operations at the Bruce NGS A and B.

CNSC staff have conducted engagement activities with the identified Indigenous Nations and communities including licence application notification, meetings, opportunities to apply for funding, addressing issues and concerns, workshop discussions, and

encouragement of Indigenous Nation participation in Commission hearing processes via interventions.

5.1.4 Conclusion

Based on CNSC staff's engagement activities to date, CNSC staff have not identified or been made aware of any concerns with respect to potential new impacts to Indigenous and/or treaty rights relating to this request. CNSC staff and Bruce Power have worked to meaningfully engage each Indigenous Nation and community. This included responding to concerns raised about CNSC's technical review of this request. Information and engagement opportunities were identified to address the concerns raised by Indigenous Nations and communities to date.

CNSC staff are committed to ongoing engagement and collaboration with interested Indigenous Nations and communities and will continue to provide opportunities for meaningful long-term engagement and collaboration with respect to Bruce Power's operations and activities in relation to the request for increased operating period. CNSC staff encourage Bruce Power to continue engagement with Indigenous Nations and communities regarding this request as well as and ongoing operations.

5.2 Participant Funding Program

The Canadian Nuclear Safety Commission (CNSC) established the Participant Funding Program (PFP) in 2011 to:

1. enhance individual, not-for-profit organization and Indigenous Nations and Communities participation in the CNSC-led environmental assessment (EA) and licensing processes for major nuclear facilities (e.g., uranium mines, nuclear power plants, nuclear substance processing, or nuclear waste facilities)
2. assist individuals, not-for-profit organizations and Indigenous Nations and Communities to bring value-added information to the Commission through informed and topic-specific interventions related to EAs and licensing (i.e., new, distinctive and relevant information that contributes to a better understanding of the anticipated effects of a project)

5.2.1 Discussion

In advance of the hearing in writing, the CNSC made up to $50,000 available through its PFP to assist Indigenous Nations and communities, members of the public and interested parties in

reviewing Bruce Power's request for extended operation and associated documents, and in participating in the Commission hearing process by providing topic-specific written interventions for the Commission's hearing in writing. Details of the funding opportunity can be found here. The deadline to apply for funding was January 12, 2026. CNSC has considered the recommendations of the independent funding review committee (FRC) on the allocation of participant funding and awarded $10,062.50 to Canadian Environmental Law Association (CELA), $37,720 to SON, and $1,500 to Dr. Frank Greening (this award was not claimed).

5.2.2 Conclusion

The CNSC continues to share regulatory and scientific information with the public through social media, webinars, community outreach, and updates on its website. The CNSC also uses tools like the PFP and online notifications to encourage people to take part in the Commission's hearing process, as described above. Through the PFP, the CNSC has offered assistance to interested members of the public, Indigenous Nations and communities, and interested parties to help them prepare for and participate in the Commission's hearing.

6 Conclusion and Recommendation

- CNSC staff conclude that Bruce Power's fuel channel fitness for service program is sufficient to support the request to extend the maximum allowable operating time of pressure tubes in Bruce NGS B Units 7 and 8 from 300,000 EFPH to 310,000 EFPH.

- CNSC Staff recommend that the Commission authorize Bruce Power to operate Bruce NGS B Units 7 and 8 to an EFPH limit of 310,000 Equivalent Full Power Hours.

7 References

1. **CMD 14-H115.1 Bruce Power Submission.** *Application to request the Approval to Operate Beyond 210,000 Equivalent Full Power Hours (EFPH).* August 14, 2014.
2. **CMD 18-H4.1 Bruce Power.** Application for the Renewal of the Power Reactor Operating Licence: Supplemental Material. March 14, 2018. https://api.cnsc-ccsn.gc.ca/dms/digital-medias/cmd18-h4-1-submissionfrombrucepowerlicencerenewalforbruceaandb-ngs.pdf/object.
3. **CMD 26-M10.** CNSC staff update on the status of licensee R&D program for elevated hydrogen equivalent concentration in the pressure tubes of reactors in extended operation. March, 2026. https://api.cnsc-ccsn.gc.ca/dms/digital-medias/CMD26-M10-CNSC-SUB-ENG.pdf/object.
4. **CNSC Record of Decision.** Application to Renew the Power Reactor Operating Licence for Bruce A and B Nuclear Generating Stations. September 27, 2018. https://api.cnsc-ccsn.gc.ca/dms/digital-medias/Decision-BrucePower-Relicensing2018-e.pdf/object.
5. **CNSC Record of Proceedings, Including Reasons for Decision.** Application to Renew the Power Reactor Operating Licences for Bruce A and Bruce B Nuclear Generating Stations. July 9, 2015. https://api.cnsc-ccsn.gc.ca/dms/digital-medias/2015-04-14-CompleteDecision-BrucePower-e-edoc4798838.pdf/object.
6. **CNSC Record of Proceedings, Including Reasons for Decision.** Bruce Nuclear Generating Station B - Request for Approval to Operate beyond 210,000 Equivalent Full Power Hours (EFPH). September 16, 2014. https://api.cnsc-ccsn.gc.ca/dms/digital-medias/2014-09-10-Decision-BrucePower-e-Edocs4501441.pdf/object.

8 Glossary

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the Regulations made under it, and in CNSC regulatory documents and other publications.

Additional terms and acronyms used in this CMD are listed below.

ACRONYMS

BOT Body of Tube

CANDU CANadian Deuterium Uranium

CT Calandria Tube

EA Environmental Assessment

EFPH Equivalent Full Power Hours

EOB End of Bearing

FP Full Power

Heq Hydrogen Equivalent Concentration

ID Inner Diameter

kEPFH Thousand Equivalent Full Power Hours

LBB Leak Before Break

LC Licence Condition

LCH Licence Condition Handbook

LISS Liquid Injection Shutdown System

MCR Major Component Replacement

NGS Nuclear Generating Station

NSCA Nuclear Safety Control Act

OPG Ontario Power Generation

PIDP Public Information and Disclosure Program

PROL Power Reactor Operating Licence

PT Pressure Tube

RJ Rolled Joint

SFCR Single Fuel Channel replacement

TSSD Terminal Solid Solubility of Dissolution

TOR Terms of Reference

Appendix A: Basis for Recommendation

The regulatory basis for the recommendations presented in this CMD is as follows:

A1: Regulatory Basis

The regulatory basis for nuclear power plants in Canada is primarily governed by the NSCA. The CNSC's regulatory framework encompasses laws, regulation, guidance documents that set out the requirements for the safe operation of nuclear facilities, ensuring public safety and environmental protection.

The primary requirements for the Bruce Nuclear Generating Stations A and B arise from the following laws and CNSC regulations:

- **Nuclear Safety and Control Act**
- **General Nuclear Safety and Control Regulations**
- **Class I Nuclear Facilities Regulations**
- **Radiation Protection Regulations**
- **Nuclear Security Regulations**
- **Nuclear Non-proliferation Import and Export Control Regulations**
- **Transportation of Dangerous Goods Regulations (TDGR)**
- **Packaging and Transport of Nuclear Substances Regulations, 2015 (PTNSR 2015)**

A2: Technical Basis

The request and accompanying documents are assessed against the following:

- CNSC REGDOC-2.6.1 Reliability Programs for Nuclear Power Plants
- CNSC REGDOC-2.6.2 Maintenance Programs for Nuclear Power Plants
- CNSC REGDOC-2.6.3 Aging Management
- CSA N285.4:14 Periodic inspection of CANDU nuclear power plant components
- CSA N285.8:21 Technical requirements for in-service evaluation of zirconium alloy pressure tubes in CANDU reactors

Appendix B: Proposed Licence Changes

There are no proposed changes to the Bruce NGS A and B PROL 18.04/2028. There are proposed changes to the licensing basis that will be reflected in the next revision of the Bruce NGS A and B LCH. Appendix [C] provides the details of the proposed change.

Appendix C: Draft LCH modification under LC 6.1

Page 72 of the Bruce NGS A and B License Conditions Handbook (LCH-PR-18.04/2028-R005) captures the limit defined at 300,000 EFPH as follows:

> *In 2017, Bruce Power requested in its licence renewal application operation of Bruce NGS A and B up to 300,000 EFPH. As a result of the 2018 licence renewal hearing proceedings, the Commission authorized operation of Bruce NGS A and B up to a maximum of 300,000 EFPH as stated in the CNSC's Record of Decision, in the matter of "Bruce Power Inc.: Application to Renew the Power Reactor Operating Licence for Bruce A and Bruce B Nuclear Generating Stations", September 27, 2018. Operation of Bruce NGS A and B beyond 300,000 EFPH is not permitted unless approved by the Commission in accordance with LC G.1.*

Should the Commission approve Bruce Power's request for extended operation, CNSC staff propose the following addition:

In 2025, Bruce Power requested approval for operation of Bruce B units 7 and 8 to a limit of 310,000 EFPH. The Commission has granted this request as captured in the Record of Decision dated [DATE] about Bruce B Units 7 and 8: Request to extend Operation up to 310,000 Equivalent Full Power Hours.