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Written submission from NB Power

Mémoire d' Énergie NB

Hydrogen Equivalent Concentration in Pressure Tubes for Nuclear Power Plants

Responses of July 19 and 30, 2021 to request pursuant to Subsection 12(2) of the *General Nuclear Safety and Control Regulations*: Issues Relating to Measurement of Hydrogen Equivalent Concentration in Pressure Tubes

Concentration d'hydrogène équivalent dans les tubes de force pour les centrales nucléaires

Réponses des 19 et 30 juillet 2021 à la demande en vertu du paragraphe 12(2) du *Règlement général sur la sûreté et la réglementation nucléaires* : Enjeux concernant la mesure de la concentration d'hydrogène équivalent dans les tubes de force

Commission Meeting

Réunion de la Commission

September 3, 2021

Le 3 septembre 2021

Canada

Énergie NB Power

Point Lepreau Nuclear Generating Station
PO Box 600, Lepreau, NB
E5J 2S6

TU 06374
PICA 21-3984

July 19, 2021

Mr. Marc LeBlanc, Commission Secretary
Commission Secretariat Directorate
Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
Ottawa, Ontario
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Dr. Alexandre Viktorov, Director General
Directorate of Power Reactor Regulation
Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
Ottawa, Ontario
KIP 5S9

Dear Mr. Marc LeBlanc, Dr. Viktorov:

Subject: **Request pursuant to Subsection 12(2) of the *General Nuclear Safety and Control Regulations:* Issues Relating to Measurements of Hydrogen Equivalent Concentration in Pressure Tubes**

The purpose of this letter is for New Brunswick Power (NBP) to respond to CNSC staffs formal request (Reference 1), in relation to recent analysis of pressure tube sampling, where it appears the currently used models may under-predict the maximum hydrogen equivalent concentration of pressure tubes in CANDU reactors.

In accordance with subsection 12(2) of the *General Nuclear Safety and Control Regulations,* NBP provides the following responses as requested under (Reference 1) by July 19, 2021:

a) *Confirmation that the request will or will not be carried out or will be carried out in part;*

NBP confirms that the request from CNSC will be carried out.

b) *Any actions that NB Power has taken to carry out the request or any part of it;*

NBP, in full support with industry, has initiated a technical review of the Bruce Power OPEX and is conducting analysis regarding pressure tube fitness for service.

c) *Any reasons why the request or any part of it will not be carried out;*

There are no known reasons why this request will not be carried out.

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d) *Any proposed alternative means to achieve the objectives of the request;*

No alternative means are being proposed to achieve the request.

e) *Any proposed alternative period within which NB Power proposes to carry out the request.*

At the time of writing this letter, NBP does not propose any alternative period to carry out this request. Should additional time be required, NBP will update the CNSC promptly.

NBP by July 30, 2021 will make a report to the Commission (Reference 1) which will address the following actions:

1) Confirm receipt of the information from Bruce Power related to this discovery;
2) Analyze the impact of the information on the demonstration of pressure tube fitness for service;
3) Conduct necessary tests and analysis to verify that operation of the reactor at Point Lepreau Nuclear Generating Station remains within its licensing basis; and
4) Inform CNSC of any other measures taken in response to this information.

Additionally, NBP confirms that by January 13, 2022 as requested (Reference 1) a report will be made to the Commission reflecting the analysis of the hydrogen update model validity, reflecting new information.

If you require additional information, please contact Nick Reicker at 506-659-7324 or nreicker@nbpower.com.

Sincerely,

Mark Power
Site Vice President

MP/NR

cc. Ramzi Jammal, Peter Elder, Mike Rinker, Anu Bulkan, Vali Tavasoli, Eric Fortier, Isabelle Gingras, Josée Giguère, Nathan Kline, Ailan Holbrook (CNSC Ottawa)
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Maury Burton, Lisa Clarke (Bruce Power)
Jack Vecchiarelli, Ghulam Khawaja (OPG)

Reference:

1. Letter: Mr. Mark Power from Mr. Alex Viktorov PhD, *"Request pursuant to Subsection 12(2) of the General Nuclear Safety and Control Regulations: Issues Relating to Measurements of Hydrogen Equivalent Concentration in Pressure Tubes"*, July 13, 2021, e-Doc 6604246.

Énergie NB Power

Point Lepreau Nuclear Generating Station
PO Box 600, Lepreau, NB
E5J 2S6

TU 06374
PICA 21-3984

July 30, 2021

Mr. Marc LeBlanc, Commission Secretary
Commission Secretariat Directorate
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Dr. Alexandre Viktorov, Director General
Directorate of Power Reactor Regulation
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KIP 5S9

Dear Mr. Marc LeBlanc, Dr. Alex Viktorov:

Subject: **Request pursuant to Subsection 12(2) of the *General Nuclear Safety and Control Regulations:* Issues Relating to Measurements of Hydrogen Equivalent Concentration in Pressure Tubes**

The purpose of this letter is for New Brunswick Power (NBP) to provide a report to CNSC staff, and the Commission as requested under (Reference 1), in relation to a recent analysis of hydrogen equivalent concentration of pressure tubes in CANDU reactors.

In accordance with subsection 12(2) of the *General Nuclear Safety and Control Regulations,* NBP was requested (Reference 1) to conduct analysis and review regarding pressure tube fitness for service and make a report to the Commission by July 30, 2021, in respect to the following actions:

1) Confirm receipt of the information from Bruce Power related to this discovery;
2) Analyze the impact of the information on the demonstration of pressure tube fitness for service;
3) Conduct necessary tests and analysis to verify that operation of the reactor at Point Lepreau Nuclear Generating Station remains within its licensing basis; and
4) Inform CNSC of any other measures taken in response to this information.

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NBP is committed to maintaining safety as the overriding priority and confirms that the required information from Bruce Power has been provided based on the discovery of higher than predicted hydrogen equivalent concentration [Heq] in B6S13. An evaluation team was assembled to analyze the OPEX from Bruce Power, and clear lines of communication remain open between NBP and the industry.

The impact of higher than predicted [Heq] on the demonstration of pressure tube fitness for service, and verification that the continued operation of the reactor at the Point Lepreau Nuclear Generating Station remains within the licensing basis was analyzed under engineering evaluation 0087-311100-3014-001-TMM-A-00 *Issues Relating to Measurements of Hydrogen Equivalent Concentration in Pressure Tubes* (Attachment 1).

The analysis completed to date has determined that pressure tube fitness for service is demonstrated for NBP. This conclusion is based on the highly localized area of interest, the likely late-life initiation of this phenomenon/mechanism, significant conservatisms in fitness for service assessments and adequate margins of model predicted [Heq] to CSA N285.4 acceptance standards and CSA N285.8 fracture toughness validity limits. The analysis has also determined that NBP continues to be compliant with the licensing basis as defined under PROL 17.01/2022, License Condition Handbook section 6.1, and continues to ensure high levels of safety to the public.

To support analysis of the hydrogen uptake model validity, reflecting new information as requested under (Reference 1), NBP had previously committed to providing a report to the Commission by January 13, 2022 (Reference 2). As required for compliance with CSA N285.4 and N285.8, NB Power will be conducting hydrogen equivalent determination inspections in April 2022 during the planned maintenance outage. These inspections will also allow for post-refurbishment rolled joint data (with front-end outlet installation configuration) to be used to validate the model. Therefore, NBP proposes to incorporate this updated data into the associated report to the Commission, and submit it by September 30, 2022, rather than January 13, 2022.

If you require additional information, please contact Nick Reicker at 506-659-7324 or nreicker@nbpower.com.

Sincerely,

For
Mark Power
Site Vice President

MP/NR

cc. Ramzi Jammal, Peter Elder, Mike Rinker, Anu Bulkan, Vali Tavasoli, Eric Fortier, Isabelle Gingras, Josée Giguère, Nathan Kline, Ailan Holbrook (CNSC Ottawa)
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1. Letter: Mr. Mark Power from Mr. Alex Viktorov PhD, *"Request pursuant to Subsection 12(2) of the General Nuclear Safety and Control Regulations: Issues Relating to Measurements of Hydrogen Equivalent Concentration in Pressure Tubes"*, July 13, 2021, e-Doc 6604246.

2. Letter: Mr. Marc Leblanc, Dr. Alex Viktorov from Mr. Mark Power, *"Request pursuant to Subsection 12(2) of the General Nuclear Safety and Control Regulations: Issues Relating to Measurements of Hydrogen Equivalent Concentration in Pressure Tubes"*, July 19, 2021.

Attachment:

1. Engineering Evaluation: 0087-311100-3014-001-TMM-A-00 *Issues Relating to Measurements of Hydrogen Equivalent Concentration in Pressure Tubes*

Document number: 0087-31100-3014-001-TMM-A-00

REGISTERED PROFESSIONAL ENGINEER
Province of New Brunswick
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Joel N. Beck
Signature
2021-07-28
Date
Province du Nouveau-Brunswick
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Approved by: Pierre Michaud Date (yyyy-mm-dd): 2021-07-28

Accepted by: Jenn Lennox Date (yyyy-mm-dd): 2021-07-28

Accepted by: Andy Hayward Date (yyyy-mm-dd): 2021-07-28

Accepted by: Mark Power Date (yyyy-mm-dd): 2021-07-29

SUBJECT: Issues Relating to Measurement of Hydrogen Equivalent Concentration in Pressure Tubes

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Summary

In response to the CNSC letter received [1], the Bruce Technical Operability Evaluation [2], including relevant references, based on the discovery of higher than predicted [Heq] in B6S13 was received. Lines of communication remain open between NB Power and industry with OPEX being shared.

The analysis completed to date (see Technical Basis for Direction section below) has determined that pressure tube fitness for service is demonstrated and PLNGS remains within its licensing bases. This conclusion is based on the highly localized area of interest, the late-life initiation of this phenomenon/mechanism, significant conservatisms in fitness for services assessments, and adequate margins to CSA N285.4 [Heq] acceptance standards and CSA N285.8 fracture toughness validity limits.

To support analysis of the hydrogen uptake model validity, reflecting new information as requested [1], NBP had previously committed to provide this a report to the Commission by January 13, 2022 [27]. As required for compliance with CSA N285.4 and N285.8, NB Power will be conducting hydrogen equivalent determination inspections in April 2022 during the planned maintenance outage. These inspections will also allow for post-refurbishment rolled joint data to be used to validate the model. Therefore, NB Power proposes to incorporate this updated data into the associated report to the Commission, and submit it by September 30, 2022, rather than January 13, 2022.

Path Forward

- Investigate Damp Circumferential Scrape (DCS) tooling capability of sampling within 20mm inboard of burnish mark and at 12 o'clock (area of interest) and determine whether scope adjustment or sampling location alterations are warranted (PICA 21-3984 Action 2 due 2021/09/30).

- Maintain the hydrogen equivalent concentration determination inspection schedule and complete campaign during the 2022 outage (PICA 21-3984 Action 3 due 2022/05/31).

- Reassess model validity with results from [Heq] measurements from the 2022 outage (PICA 21-3984 Action 4 due 2022/09/30).

- If it is found that any input parameter to any evaluation is deemed invalid based on the 2022 inspection results, as per standard practice through CSA N285.8 Clause 4.5.1.3, the evaluation shall be repeated using the correct value for the input parameter and the Authority Holding Jurisdiction (AHJ) shall be notified of the revised evaluation and the conclusions reached (PICA 21-3984 Action 5 due 2022/12/31).

Technical Basis for Direction

Regarding Reference [1], Item 1, "confirm receipt of the information from Bruce Power related to this discovery", the Bruce Technical Operability Evaluation (TOE) [2] and relevant references were received. The fitness for service assessment of the 2021 Bruce Unit 3 planned outage (A2131) has not yet been completed as the unit is still offline, however the preliminary findings have been taken into consideration. Therefore, this evaluation is mainly focussed on the results of Bruce Power Unit 6 discovery [2], with the understanding that the Bruce Unit 6 fuel channel S13 (B6S13) result is not a unique occurrence isolated to that specific pressure tube.

PLNGS continues to meet the Licensing basis established by PROL 17.01/2022, Licence Condition 6.1 [3]. The licensing basis informs the process for returning the reactor to service following planned outages in which periodic inspections on fuel channels are performed as required by CSA N285.4-09 [4]. Following the last fuel channel inspection outage in 2019, PLNGS was returned to service once regulatory acceptance of submitted component fitness for service assessments and dispositions were received. These assessment submissions were in accordance with the criteria, methodologies, or models established within CSA N285.4-09, CSA N285.8-10 [5], CSA N285.8-15 [6], or approved for use by the CNSC.

In accordance with the Compliance Verification Criteria stipulated by the Licence Conditions Handbook [3], Section 6.1, the standards to be adhered to are CSA N285.4-09 [4] and CSA N285.8-10 [5]. However, as part of the transition to the implementation to new editions of the standards, the CNSC has requested that CSA N285.4-14 [7] and CSA N285.8-15 [8] be used for [Heq] related assessments.

CSA N285.4-14, Clause 12.3.5.2.2 Rolled Joint H_{eq} Measurements, acceptance standards are the following (also consistent with CSA N285.4-19):

For rolled joint Heq measurements, the determination of Heq shall be considered acceptable when the predicted Heq inboard from the mechanically rolled transition (burnish mark) does not exceed, at the end of the next periodic interval
a) 70 ppm for the inlet rolled-joint region; and
b) 100 ppm for the outlet rolled-joint region.

As of July 15, 2021, PLNGS pressure tubes have 66,657 Hot Hours (HH) or 61,698 Equivalent Full Power Hours (EFPH) [9]. Using a conservative value for $H_{initial}$ of 5ppm [10] and a conservative (further outboard) axial location of 68mm from end of pressure tube (PT) to burnish mark (BM) [11 and 12], rolled joint models [13] predict the Peak [Heq] to be 39.9 ppm in the inlet rolled joint (IRJ) and 58.1 ppm in the outlet rolled joint (ORJ) at the current time. At the end of the next periodic inspection interval the operation time is conservatively estimated to be 108,500 EFPH [14] – using the current ratio of HH:EFPH of 1.08, this translates to 117,206 HH. Using the same methodology as above, the predicted peak [Heq] at the end of the next inspection interval is predicted to be 43.3 ppm at the IRJ and 72.5 ppm at the ORJ. These predictions have significant margin to the acceptance standard allowable limits in CSA N285.4.

The current deuterium uptake models are conservative by design. The Body of Tube (BOT) deuterium uptake model has the following conservatisms built-in [15]:

- an Arrhenius-type form with capped time-dependent threshold temperature to account for deuterium peak formation and its movement inboard with operating time
- a time exponent to account for an acceleration of deuterium uptake with operating time
- model is based on the pre-refurbishment data from Point Lepreau in-service scrape campaigns and surveillance examinations – i.e., higher $H_{initial}$ pressure tubes
- model shows conservative predictions for the post-refurbishment data and bounds all of the 2016 BOT scrape campaign data.

The pre-refurbishment pressure tubes on which this model is based had $H_{initial}$ concentrations of up to 16ppm [16]. The post-refurbishment pressure tubes currently in the core have a tighter material specification with a $H_{initial}$ of less than 5ppm [17] and therefore have conservative [Heq] predictions and additional margin to the allowable limits.

Similarly, the generic deterministic hydrogen equivalent concentration predictions for inlet and outlet rolled joint regions of pressure tubes are based on pre-refurbishment Single Fuel Channel Replacements (SFCRs) and have the following built-in conservatisms [16]:

- Waterside corrosion deuterium ingress contribution used the 97.5 percentile upper bound predictions of the BOT model [15]

- Deuterium ingress contribution for IRJs used the CANDU 6 scaling factor (SF) of 1.6 and for ORJs, an increased SF of 1.6 (compared to the Bruce A upper bound: 1.26) was used to bound all pre-refurbishment removed tube data, especially in the compressive RJ region.

Outside the area of interest (as described in the Background section below), it has been demonstrated that the models are still bounding the measurement data [redacted] PLNGS pre-refurbishment SFCR data is well bounded by the ORJ models as can be seen in the figures below from [16].

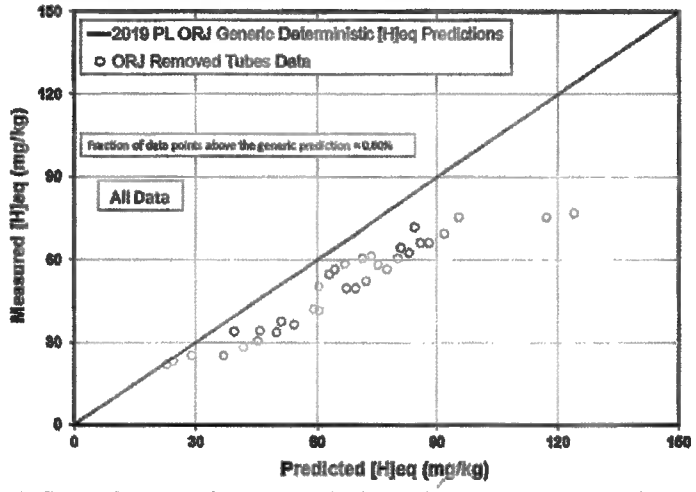


Figure 1: Comparison of Point Lepreau Outlet RJ [H_{eq}]Measurements with the 2019 Outlet Generic Deterministic RJ [H_{eq}] Predictions (Data From Both Regions)

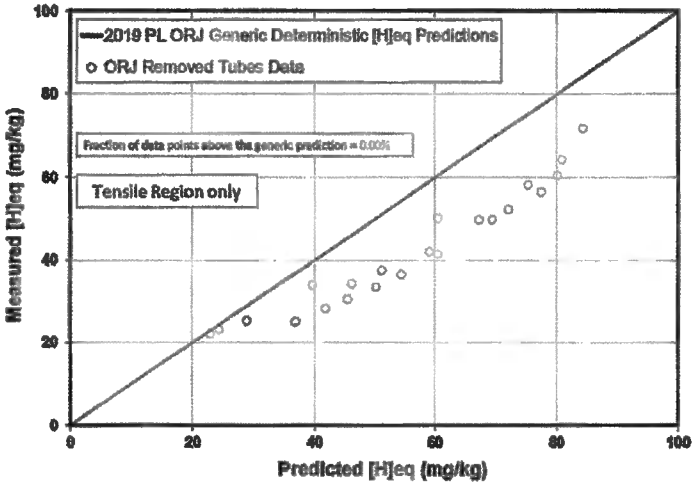


Figure 2: Comparison of Point Lepreau Outlet RJ [H_{eq}]Measurements with the 2019 Outlet Generic Deterministic RJ [H_{eq}] Predictions (Tensile Region Data Only)

[redacted] The table below is a relative comparison of the Hot Hours from each station:

Unit	Hot Hours	Date
[redacted]		
PLNGS Unit 1	66,657	July 15, 2021

Results from all PLNGS post-refurbishment fuel channel inspections indicate that material property trends are bounded by the models, and that predictions have not been exceeded [15 and 16]. There exists significant margin to acceptance standard limits and the fuel channels continue to meet their fitness for service requirements [10, 13, 14, 18, 19, and 22]. Based on the above information, and industry engineering reviews, it is understood that PLNGS post-refurbishment pressure tubes are too early in their service life to exhibit the conditions observed in Bruce Units 3 and 6. [redacted]

The current model for fracture toughness in CSA N285.8 has a validity limit on the hydrogen equivalent concentration in pressure tubes of 80ppm up to 1.5m away from the front end of the tube (as referenced from the end of the tube coming out first during extrusion) and 120 ppm beyond 1.5m from the front end. At PLNGS, like [redacted] Prior to refurbishment, PLNGS had pressure tubes installed in the Front End Inlet (FEI) orientation [redacted] As previously mentioned, due to the low number of hot hours (i.e., low predicted [Heq]) and inherent conservatism in the [Heq] RJ models, there remains adequate margin to the fracture toughness validity limits until the end of the next inspection interval – November 2026. Currently, the industry is developing a revision to the fracture toughness model that will increase the validity limit on the front end of pressure tubes to 100ppm, which is planned to be implemented before the end of the next inspection interval and before PLNGS peak ORJ [Heq] is predicted to surpass the current revision 80ppm limit.

It follows that the Deterministic Fracture Protection (DFP) assessment remains a conservative evaluation due to the compounding effect of the following conservative assumptions used [18]:

- Lower-bound fracture toughness (2.5th percentile for Service Level A & B, 10th percentile for Service Level C & D)

- A reduction factor of 1.04 was applied to the fracture toughness model to account for the potential reinforcement effect of the liner patch used in the rising pressure burst tests

- Upper-bound [Heq] predictions (97.5th percentile for BOT [15], peak [Heq] for RJ assuming $H_{initial}$ of 5ppm [16])
  - [Heq] predictions at the outboard end of the postulated through-wall flaw are used if the flaw is postulated to reside within 500 mm of the end of the PT. If the postulated flaw resides in the BOT, further inboard than 500mm from the end of the PT, the [Heq] predictions are calculated at the mid-location of the postulated flaw.

- Bounding chlorine concentration (2.5ppm used, specification is 0.5 ppm max)

- The transverse flow stress for fully-irradiated pressure tube material was calculated using lower bound tensile properties (yield stress, ultimate tensile strength)

- Bounding pressure tube dimension predictions based on design creep rates and corrosion and wear allowances

- Safety Factors used for evaluation of Service Level A & B loadings (1.3 for shutdown state, 1.5 otherwise)

- Assumed that postulated 20 mm long axial through-wall flaw is not leaking and hence would not be detected by the Annulus Gas System (AGS).

Similarly, the deterministic Leak-Before-Break (LBB) assessment also has the following conservatisms built-in [19]:

- Lower-bound fracture toughness (2.5th percentile)
  - A reduction factor of 1.04 was applied to the fracture toughness model to account for the potential reinforcement effect of the liner patch used in the rising pressure burst tests

- Upper-bound [Heq] predictions (97.5th percentile for BOT [15])
  - RJ contributions to [Heq] assumed up to 500mm from the end of the PT and were determined using [16]

- If the axial through-wall crack is postulated to be in the rolled joint region, crack growth is conservatively postulated up to 5 mm outboard of the burnish mark as no flaw growth occurs in the compressive stress regions of the pressure tube rolled joint

- [Heq] is conservatively calculated at the outboard crack-tip if the crack is located in either the inlet or outlet rolled joint region

- Bounding chlorine concentration (2.5ppm used, specification is 0.5 ppm max)
- The maximum design pressure tube inner radius (52.11 mm) and the minimum design pressure tube wall thickness (4.191 mm) were used in the assessments as the initial in-service dimensions
- Only the beetle alarm is being credited for the purposes of this assessment and the mass of primary heat transport system fluid leakage required to initiate a beetle alarm in an eleven (11) channel AGS string is conservatively applied to all fuel channels in this assessment, regardless of the fuel channel annulus position within an AGS string
- Upper-bound growth rates as per the interim model for axial Delayed Hydride Cracking growth Rate (DHCR) were used
- Fully irradiated transverse lower-bound yield stress and ultimate tensile strength as per Annex D.3.4 of CSA N285.8-15 were used
- A conservative leak rate for pressure tube Leak Before Break (LBB) evaluations as per Annex D.12 of CSA N285.8-15 was used

[redacted] Due to the limited amount of inspection data available on the post-refurbishment PLNGS core, it was accepted that a Probabilistic Core Assessment (PCA) could be deferred until after the second interval volumetric and dimensional inspection campaign as planned for 2024 [21]. In lieu of a PCA, the verified UT results from the 2014 [23] and 2019 [24] CIGAR campaigns were reviewed and found that there were no ID flaws in the area of interest [redacted]
The search was then expanded axially inboard to include the BM to BM+40mm, and circumferentially to the top 120° of the pressure tube, and still no ID flaws were detected in this area.

In accordance with the submission letter of the 2019 volumetric and dimensional inspection campaign results and subsequent acceptance by the CNSC [20 and 21], there has not been a pressure tube detected, predicted, or assumed to be in contact with a calandria tube, therefore a pressure tube to calandria tube (PT/CT) contact assessment as per Clause 7.3.3 of CSA N285.8 was not required. Considering that the gap measured in all locations of the pressure tubes inspected is within acceptable limits [22], that tight-fitting spacers are not expected to move this early in life and all detected and confirmed annulus spacers remained in their design locations, and that no contact is predicted until the end of life if spacers remain in their design locations, the high [Heq] measured in B6S13 does not pose concern for risk of hydride blister formation at PLNGS due to PT/CT contact.

Based on the above evaluation, the fitness for service assessments have sufficient conservatism and result in adequate margins to acceptance standards such that there is no concern of the [redacted] having an immediate impact on PLNGS fuel channel fitness for service.

The time in service of PLNGS pressure tubes is low in comparison to those at Bruce Unit 6 (and Unit 3). Fuel channel health is being monitored as per the Fuel Channel Management Plan (FCMP) [25] and PLNGS is confident that the post refurbishment pressure tubes are many operating years away from manifesting the conditions as seen in B6S13. Pressure tube [Heq] will be closely monitored and tracked as per the FCMP [25] in the upcoming scheduled inspection campaigns and will allow for anticipation of this phenomenon.

The next planned hydrogen equivalent determination inspection, including rolled joint measurements, is scheduled for April 2022. As the rolled joint measurements will be performed for the first time since refurbishment, PLNGS will use these values in conjunction with the Bruce OPEX to validate and update the [Heq] model.

The pre-refurbishment SFCR pressure tubes on which the model is based were installed in the FEI orientation, and the effects of FEO orientation (post-refurbishment pressure tubes) on deuterium uptake rates need to be confirmed.

The proposed scrape locations for the 2022 campaign, based on industry best practices and the requirements of CSA N285.4 [4], are as follows [26]:

- between the first and second rolling grooves
- between the second and third rolling grooves
- BM+50mm
- BM+300mm.

Considerations should be made to understand the feasibility of the Damp Circumferential Scrape (DCS) tooling to scrape in the area of interest (BM to BM+20mm) should be determined, and whether or not a scope addition or scrape location adjustment is warranted.

Background

The purpose of this evaluation is to address the letter titled "Request pursuant to Subsection 12(2) of the *General Nuclear Safety and Control Regulations*: Issues Relating to Measurement of Hydrogen Equivalent Concentration in Pressure Tubes" [1], received on July 13, 2021, see PICA 21-3984. More specifically, to address the following from [1]:

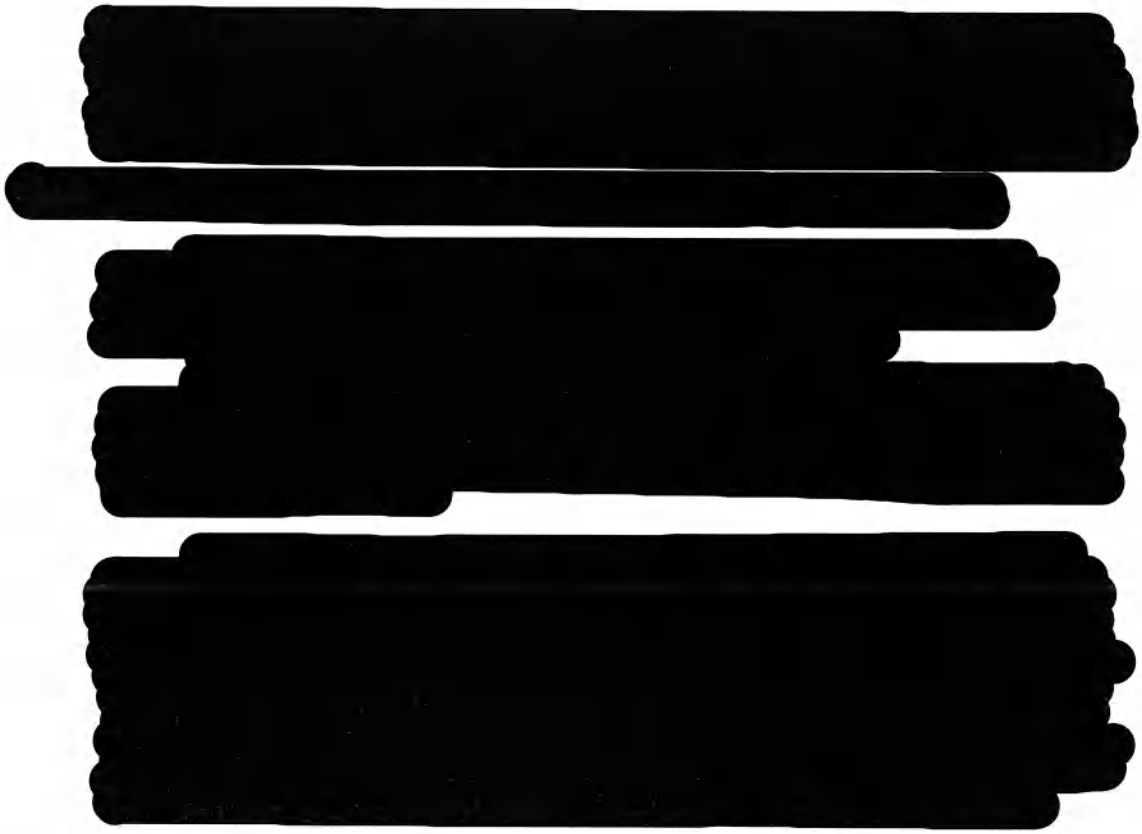
> *...This letter is a formal request made pursuant to subsection 12(2) of the General Nuclear Safety and Control Regulations. Based on information reported to the Canadian Nuclear Safety Commission (CNSC) by Bruce Power, in relation to recent analysis of pressure tube sampling, it appears that the currently used models may under-predict the maximum hydrogen equivalent concentration in pressure tubes of CANDU reactors.*
>
> *In accordance with Licence Condition G.1 of PROL 17.01/2022 and Section G.1 of Licence Condition Handbook LCH-PR-17.00/2022-R001, licensed activities shall be conducted in accordance with the licensing basis. In addition, "for unapproved operation*

that is not in accordance with the licensing basis, the licensee shall take action as soon as practicable to return to a state consistent with the licensing basis, taking into account the risk significance of the situation"...

Pursuant to my authority as a person authorized by the Commission for the purposes of subsection 12(2) of the General Nuclear Safety and Control Regulations, I request that New Brunswick Power (NB Power) conduct analysis and review regarding pressure tube fitness for service, and make a report to the Commission, no later than July 30, 2021, in respect of the following actions:

1. *Confirm receipt of the information from Bruce Power related to this discovery;*
2. *Analyze the impact of this information on the demonstration of pressure tube fitness for service;*
3. *Conduct necessary tests and analysis to verify that operation of the reactor at Point Lepreau Nuclear Generating Station remains within its licensing bases; and*
4. *Inform CNSC of any other measures taken in response to this information.*

[redacted]



References

[1] CNSC Letter, A. Viktorov to M. Power, e-Doc # 6604246, "PLNGS: Request pursuant to Subsection 12(2) of the General Nuclear Safety and Control Regulations: Issues Relating to Measurement of Hydrogen Equivalent Concentration in Pressure Tubes", July 13, 2021.

[2]

[3] NB Power LCH, NBP Doc # 0087-00583-2022-001-LP-A-02, e-Doc 6117084, "Nuclear Power Reactor Operating Licence Point Lepreau Nuclear Generating Station", April 17, 2020.

[4] CSA Document: N285.4-09 Update No. 2, "Periodic Inspection of CANDU Nuclear Power Plant Components", June 2011.

[5] CSA Document: N285.8-10 Update No. 2, "Technical Requirements for In-Service Evaluation of Zirconium Alloy Pressure Tubes in CANDU Reactors", June 2013.

[6] CSA Document: N285.8-15 Update No. 1, "Technical Requirements for In-Service Evaluation of Zirconium Alloy Pressure Tubes in CANDU Reactors", October 2019.

[7] CNSC Letter, J. Burta to B. Plummer, e-Doc # 5945514, "CNSC Staff Response to Request for Closure of the Rolled Joint Hydrogen Scrapes from the 2016 Scrape Campaign -Action Item 171205-9649", July 16, 2019.

[8] CNSC Letter, P. Webster to M. Power, "CNSC Staff Review of Fuel Channel Leak-Before-Break and Protection Against Fracture Assessment Submissions for Acceptance and Concession Request to CSA N285.8-10", December 2, 2020, e-Doc 6429695.

[9] NB Power E-mail: R. Cusson to B. Boyle, "RE: EFPH and HH as of 2021-07-15", July 15, 2021.

[10] T. Langlais, "Initial Hydrogen Concentration for PLGS Post Refurbishment Pressure Tubes - Verified Product", Kinectrics File DX134/IC/032 R00, October 19, 2016.

[11] NB Power Document # 0087-31100-0004-001-GA-E-10, "Fuel Channel Major Assembly", December 13, 2012

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