Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

CMD 26-M10.1A
CMD 26-M10.2A

Date: 2026-03-11

Supplementary Information

Presentation from Bruce Power and Ontario Power Generation Inc.

In the matter of the

Status of licensee research and development commitments on elevated hydrogen equivalent concentration in pressure tubes

Commission Meeting

March 2026

Renseignements supplémentaires

Présentation de Bruce Power et Ontario Power Generation Inc.

À l'égard de l'

État des engagements en matière de recherche et développement de titulaires de permis sur les concentrations élevées d'hydrogène équivalent dans les tubes de force

Réunion de la Commission

Mars 2026

Document ID: QQQVZZNDK725-166150894-10825 (PDF)

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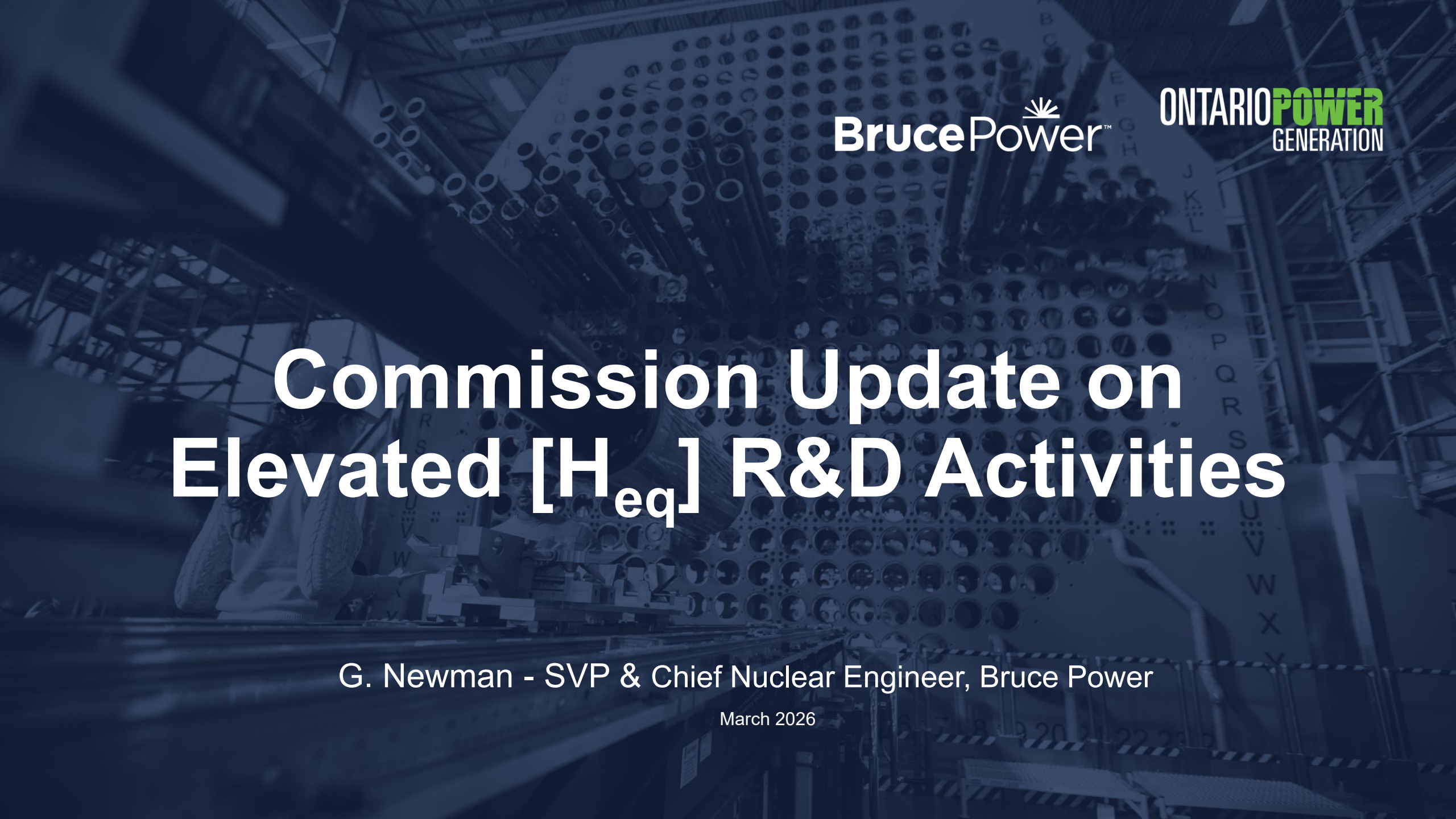

Commission Update on Elevated [H_{eq}] R&D Activities

G. Newman - SVP & Chief Nuclear Engineer, Bruce Power

March 2026

Commission Update

- Bruce Power and OPG have provided semi-annual updates to the CNSC on the research and development (R&D) roadmap activities on elevated [H_{eq}] concentrations in inlet and outlet rolled joints (RJs) in pressure tubes (PTs).

- Industry workshops provided updates to CNSC staff on the [H_{eq}] roadmap activities.
  - All [H_{eq}] roadmap activities scheduled for completion by end of 2025 were completed.
  - One remaining item, the Comprehensive [H_{eq}] model is on track to be completed by Q2 2026 as scheduled.

Key Takeaway

Industry have successfully completed the R&D roadmap activities planned for end of 2025 and addressed CNSC staff feedback.

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Commission Update

- Significant amount of data has been obtained through both in-service pressure tube inspections and surveillance examinations from different Units and Stations.
  - The inlet region of interest (ROI) is limited to the “blip” on the pressure tube outside diameter.
  - The outlet region of interest (ROI) is limited to 120 degrees on the upper half of the pressure tube (PT).
- Inlet rolled joint modelling activities have shown that the presence of a “blip” on the pressure tube outer diameter (OD) has minimal impact on a postulated flaw tip hydrided region closer to the PT inner diameter.
  - The risk of crack initiation in the inlet ROI due to limited impact of the presence of a blip on postulated flaw tip hydrided region is low.

Key Takeaway

Inlet ROI can be explained and the risk of crack initiation due to limited impact of a blip on a postulated flaw tip hydrided region close to PT inner diameter is low.

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Commission Update

- Outlet RJ modelling activities have been able to model the [H_{eq}] concentrations in the outlet RJ with the circumferential temperature gradients.

- Evidence of circumferential redistribution of [H_{eq}] from the bottom of the PT to the top of the PT in the outlet RJs was observed due to temperature gradient from top to bottom due PT diametral expansion.
  - Regular inspections continue to confirm no dispositionable flaws of significance in the outlet ROI and demonstrate low risk of crack initiation.

Key Takeaway

Outlet ROI can be explained. There is no pressure tube integrity concern due to no flaws in the outlet ROI.

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Commission Update

- Experiments were completed on the crack initiation properties with low levels of bulk [H_{eq}] and high levels of bulk [H_{eq}] greater than 200 ppm (up to 240 ppm) in unirradiated/irradiated specimens.

- Industry developed approaches for evaluating flaws for crack initiation due to delayed hydride cracking (DHC), hydrided region overloads, and fatigue with bulk [H_{eq}] up to 240 ppm and documented the current understanding for through-wall gradients of high [H_{eq}].

Key Takeaway

Crack initiation models can be applied to material with bulk [Heq] values up to 240 ppm.

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Commission Update

- Bruce Power and OPG demonstrated pressure tube fitness-for-service by evaluating the impact of elevated Heq in the Regions of Interest (ROIs) in both the inlet and outlet rolled joint regions through the completion of the R&D roadmap activities.

- CNSC staff concluded that Bruce Power and OPG has developed the necessary understanding to complete fitness-for-service evaluations under Licence Condition Handbook Section 6.1.
  - LCH Section 6.2 is being updated accordingly.
  - Longer term activities on understanding elevated [H_{eq}] observations in PTs will continue beyond 2025.

Key Takeaway

Bruce Power and OPG demonstrated pressure tube fitness-for-service by evaluating the impact of elevated Heq in the Regions of Interest (ROIs) in both the inlet and outlet rolled joint regions.

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Thank you
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