Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

CMD 22-M37.8

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Written submission from the External Advisory Committee

Mémoire du Comité consultatif externe

CNSC staff update on elevated hydrogen equivalent concentration discovery events in the pressure tubes of reactors in extended operation

Mise à jour du personnel de la CCSN sur les événements liés aux découvertes de concentrations élevées d'hydrogène équivalent dans les tubes de forces de réacteurs en exploitation prolongée

Commission Meeting

Réunion de la Commission

November 3, 2022

Le 3 novembre 2022

Canada

Submission from EAC for Nov 3, 2022 CNSC Meeting

Page and location	Question or Comment	Context
	CMD 22-M37.1 OPG	
p.2 of 18	Why have two slightly different ROI circumferential extents (see items I and ii). This adds unnecessary complexity.	Comment at a previous meeting, suggesting to standardize ROI's between OPG, Bruce Power and CNSC not acted upon.
p.10 of 18	Modelling predicts that bearing contact will shift from Bottom Dead Center to Top Dead Center at end of life: a) Does every channel at Darlington and Pickering undergo this shift or is only a few at random? b) Is the Bearing Contact Point shifted at power, at shut down but at high temperature, or even at low temperature? c) What is the impact of this shift on units which are life-limited by bearing travel? d) How does this shifted Bearing Contact Point affect the loading on the garter springs?	If a and b are predictable and cover all the lead channels, this could provide a new strategy for extending units in c). d) is bad if it imposes loads on IX750 garter springs, or if it reduces loads on P5-8 garter springs and causes them to shift to un-favourable places. May cause extra Pressure tube /Calandria tube contacts or at least extra SLAR needs.
p.9 of 18	What difference in temperature between the top of the pressure tube and the bottom (i.e., "delta T") do your models predict (or assume)? Some intervenors have found that the required delta T to cause the observed levels of hydrogen migration is unrealistic. Without access to the quantitative results, we cannot determine why there is a difference in the modelled delta T's.	

Submission from EAC for Nov 3, 2022 CNSC Meeting

Appendix 1, starting on p. 9 of 18	2C, 2G: Findings and conclusions are presented in vague, qualitative terms. How can the CNSC get a sense of the remaining margins is there are no quantitative data?	
	3A: What is "low likelihood" 10E-2, 10E-3, 10E-4, 10E-5,10E-6? 3F: Two independent pressure tube failures are "very unlikely". But has the possibility of the pressure surge accompanying a catastrophic pressure tube failure causing another weakened pressure tube to fail been considered.	Consequential pressure failures are outside the design basis and are not allowed.
	4D: It is difficult to understand why a feasibility study would take up to 8 months, i.e., end of Q2, 2023.	Work which relies on reactor data takes time because the time between outages is long. But an assessment of whether a non-active laboratory experiment is feasible should not take 8 months.
	5: 4 years is a long time for a model to be completed, especially when the earlier sections in this CMD seem to say that the current models can reproduce the observed field observation - does that meant it is still worthwhile?	All Darlington units and most Bruce units will be through or in their MCR campaign. Even if a one-year extension of Pickering B were feasible, it would also be over by 2026.
	CMD 22-M37.2 NBPower	
	No comments or questions. Their pressure tubes are young, and they are participating in the industry OPEX and R&D programs.	

	CMD 22-M37.3 Bruce Power	
	While this CMD presents some numerical results of the assessments (which is better than the OPG CMD), all the comments on the OPG CMD above also apply to the Bruce CMD.	
	General Question: You have postulated that there are different mechanisms of hydrogen behaviour at the inlet and the outlet ends of the pressure tube. Is it possible that the process which produces the 'blip' (postulated for inlet) in fact operates at both ends of the vulnerable pressure tubes, but that the blip is hidden at the outlet end due to the large amount of hydrogen movement/redistribution that is occurring due to the delta T?	
	General Question: some of the intervenors have asked questions about the ratio of H to D in the samples. There may be another mechanism at work to increase the H concentration, in addition to the redistribution that is occurring due to the delta T. Do you have any comments on this possibility and do you intend to review the ratio of H/D question?	
	CMD 22-M37 CNSC Staff	
		This CMD is well written and gives a very thorough history of these issues.
p.20 last para	"probabilistic evaluations..(*of fracture protection and leak-before-break)* …lack of evidence that…appropriate for all PTs". Is the use of probabilistic assessments by the	See for example OPG p. 12 item 3E.

	licensees in their current CMDs consistent with the Staff concern on applicability?	
p.22	When the Risk Significance level is judged to be tolerable for 2-3 years, is that based on the projected rates of flaw and [Heq] progression, or is it a "time at risk" argument?	"Time at risk" arguments are fraught with problems.
p.23 Point 2	"Material surveillance ….by removing…pressure to provide a statistically significant sample size". What is the statistical level that must be met, and how many pressure tubes would be needed to satisfy this level?	Representing a population of several hundred pressure tubes in a unit requires a large number of samples, a major impact on the MCR or refurb.
p. 23 Section 3	When is the RIDM report going to be issued?	
p.23 Section 4	"...industry's R&D plans are in the right direction…". But are the expected completion dates acceptable?	Completion dates are after most units have reached end of life.
p.25	The restriction on "front end" of tubes is 100 ppm if at the outlet and 80 ppm if at the inlet. The licensee CMDs quote the 120 ppm limit, but not the more restrictive "front end" limits. What is the number (estimated or measured) of tubes which fail to meet these tighter limits.	