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**Update from
Ontario Power Generation**

**Mise à jour
d'Ontario Power Generation**

**Responses to questions raised on
steam generators during the
February 20, 2019 Commission
Meeting**

**Réponses aux questions soulevées au
sujet des générateurs de vapeur lors
de la réunion de la Commission du
20 février 2019**

Commission Meeting

Réunion de la Commission

May 15, 2019

Le 15 mai 2019

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NK38-CORR-00531-20740

Dear Ms. Riendeau:

Darlington NGS – Follow up to February 20, 2019, Commission Meeting Questions Related to Steam Generators

The purpose of this email is to provide follow up details related to questions asked by Commission Member Lacroix at the February 20, 2019, CNSC Commission Meeting. Please pass this information on as you see fit.

The text below is from the transcript of the Feb 20 Commission Meeting. The OPG response has been provided by our Major Components Engineering Division and is intended as a brief, high level answer to the Commission Member's questions.

MEMBER LACROIX: Yes, thank you. The steam generators are not replaced because they are still fit for service, I presume. How often are they cleaned during their lifetime?

MR. GREGORIS: Steve Gregoris, for the record. Steam generators are part of the lifecycle management program. Our major components engineering group specifies the required inspections and cleaning. Typically they're done every three years as part of the planned outage cycle.

MEMBER LACROIX: Three years, okay. How are they cleaned, mechanical means, chemical means?

MR. REINER: So, two processes. It's a mechanical process. Primary side is -- the analogy I'd give you is it's almost like a sand blasting on the primary side. On the secondary side it's a water lance cleaning.

OPG Response: Darlington Steam Generators go through a secondary side waterlancing every 3 years to remove sludge at the tubesheet. Recently Darlington Unit 2 Steam Generators were subject to a primary side clean for the first time during Unit 2 refurbishment to remove a build-up of magnetite that has occurred through it's first operating cycle. All other Darlington units also have a primary side clean planned for the refurbishment outages. Both waterlancing and primary side cleaning are a mechanical cleaning.

MEMBER LACROIX: And if you compare a steam generator in a CANDU reactor versus a steam generator in a PWR, what are the differences in terms of the outing deposits?

MR. REINER: Dietmar Reiner, for the record. This is beyond my ability to answer here. Now we can get you an answer to that question, but I'll turn it over to Steve, he may have some insights he can share.

MR. GREGORIS: Steve Gregoris, for the record. So, the question I believe, Commissioner, was specific to BWRs, boiling water reactors; is that correct?

MEMBER LACROIX: PWR.

MR. GREGORIS: Oh, PWRs. So, in that case I would say on a secondary side there is not much difference, there's a similar type of steam cycle that happens and so that kind of cleaning would be similar for both. But on the reactor side, conditions are quite different between those reactors, and so there would be different inspections. And the cleaning is quite different. The cleaning that was done, I'll just clarify, in the refurbishment much more extensive than we would typically do in a planned outage.

OPG Response: There is no difference in primary side inspection of CANDU and PWR Steam Generators. While there are similarities in the secondary side deposit, CANDU steam generators have primary side magnetite deposition which is not applicable to PWRs. It should be noted that CANDU Steam Generators operate at lower temperatures in comparison to PWR reactors.

MEMBER LACROIX: And what lessons have you learned over the years, in the sense that, do you find that there is more filing on the cool leg than on the hot leg, do you find a correlation with, I don't know, tube fretting or vibration? Could you expand on this?

MR. GREGORIS: Steve Gregoris, for the record. So, I don't have the details for the question, Commissioner. We can certainly get that to you. You know, what I would say is that we do our inspections, there are code standard requirements. We don't have any preferential type of degradation mechanisms or degradation occurring in those steam generators, they are very healthy as previously mentioned. And so I'll just say the high level, nothing specific to mention, but we'll certainly get you that information.

OPG Response: Hard Sludge deposit is typically observed on the secondary hot leg side of tubesheet and loose sludge is typically observed over the entire tubesheet.

Darlington Steam Generator tubing is comprised of alloy 800 and does not have any active corrosion related degradation mechanisms associated with secondary side deposit. Fretting at U-bend supports is an active degradation mechanism in Darlington and remains mitigated after the installation of auxiliary anti vibration bars in early 2000 in all 4 units. Darlington Steam Generator tubing is impacted by hydrodynamic degradation in the cold leg preheater region, which does not show any significant evidence of new initiation or growth since it was first reported in 2007.

Deposition of magnetite is more significant in the cold leg side compared to the hot leg side, though this phenomena has not led to any significant degradations or decline in performance. Furthermore, with primary side clean being done during refurbishment outages to remove years of magnetite build-up, it is expected that this build-up will be minimized post refurbishment as a result of installing higher chromium feeders which should lower the corrosion rates of feeders and ultimately magnetite transport within the Heat Transport System.

MEMBER LACROIX: The reason for these questions are related to the safety itself. The more you clean, the more you end up with wastes and you have to store this waste and eventually becomes a problem of contamination and storage, long-term storage.

MR. REINER: Dietmar Reiner, for the record. That is correct. And specifically the primary side clean that we executed on the refurbishment, I believe in Mr. Rose's presentation there was a number there of 5,000 kg of magnetite. That does get stored in shielded waste containers and is

a waste product that needs to be dealt with on a long-term basis as part of the refurbishment waste.

OPG Response: Cleaning of secondary side of the Steam Generators (chemical or mechanical) is performed as a maintenance activity routinely to proactively prevent degradation of steam generator tubing which is both a pressure and containment boundary. The waste from cleaning activities is disposed of as active waste and, if it is not proactively removed, it not only can result in Steam Generator tubing and internal degradation, but it can have adverse safety consequences associated with primary to secondary leakage. Whether it is removed proactively or reactively the waste associated with boiler secondary side sludge, or primary side magnetite ultimately needs to be disposed of at the end of the steam generator's life cycle.

We hope this information is helpful. Feel free to contact me if you have any questions or comments.

Mark Bosley,
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