

1 Q. **Reference: PUB-NLH-072.** In its response, Hydro advises that the Hardwoods Gas  
2 Turbine was taken off-line due to the discovery of cracks in the rotor retaining rings  
3 on inspection of the Stephenville Gas Turbine in 2012, raising a "catastrophic failure  
4 risk". Please provide copies of all manuals, reports, notices, bulletins, and any other  
5 form of advisories identifying this risk issued by the manufacturer, or by others, and  
6 advise as to how and when any Hydro personnel first received any such manuals,  
7 reports, notices, bulletins, and any other form of advisories identifying this risk.

8  
9  
10 A. Hydro entered into discussions with Brush Electric upon discovery of the cracked  
11 rotor retaining rings in Stephenville and the fact that Hardwoods was of the same  
12 vintage and material. Brush Electric advised Hydro that the Hardwoods Gas Turbine  
13 be taken off-line due to risk of catastrophic failure. On February 1, 2013, Brush  
14 Electric provided a letter to Hydro advising the same for Hardwoods and a copy of  
15 the letter is attached as IC-NLH-009 Attachment 1.



February 1, 2013

FAO: Alberta Marche

c.c. Hughie Ireland

Rodney Champion

Rob Cater

**Subject: Stephenville Gas Turbine Alternator Retaining Ring Cracking**

Dear Alberta,

Thank you for taking the time to talk to me on Friday 25<sup>th</sup> January 2013, and my revised findings, following our discussions are detailed below.

While performing a dimensional inspection of the Stephenville gas turbine alternator turbine end retaining ring Brush GMS noted several visually apparent axial cracks in the interference fit area. Examples are shown in Figures 1 (as found) and 2 (corrosion and paint removed) below:

Figure 1: Axial Retaining Ring Crack

Figure 2: Axial Retaining Ring Crack

Some cracks were found to be entirely through the wall of the retaining ring interference fit area; therefore the risk of crack propagation leading to failure of the retaining ring is high. Retaining ring failure is a catastrophic event which involves significant plant damage and potential personnel safety risks.

The subject retaining rings were made of 18-5 stainless steel. This material was widely used in the power generation industry for retaining rings but its use was discontinued in the late 1980's when it was found to be susceptible to stress corrosion cracking. Stress corrosion cracking requires the material to be under stress and exposed to a corrosive element in order to initiate. In the instance of 18-5 stainless steel the corrosive element is water or airborne moisture. It has been well established that 18-5 retaining rings in coastal climates, or locations with high humidity, are more susceptible to stress corrosion cracking than retaining rings in dry climates.

Therefore, because the subject retaining rings are of a similar vintage and identical to those on the Nalcor sister unit (Hardwoods), unless Nalcor has previously replaced the sister unit's retaining rings, Brush GMS strongly recommends that the sister unit be brought offline at the earliest possible opportunity to facilitate a thorough retaining ring inspection. This would require the rotor to be extracted and rotor removed so that full NDT processes can be conducted.

In the meantime, if the unit cannot be brought offline in the very near future for a full inspection, the following risk mitigating measures are suggested,



External inspection of retaining ring surfaces using a Borescope. The generator would not be fully dismantled but cover plates would need to be removed to gain the required access. This would require a 3-5 day shutdown (may be possible to reduce with 24/7 working?).

1. Limit generator to emergency use only.
2. Operate generator unit remotely – no personnel on site.
3. Attempt to limit frequent start stop cycles.
4. Ensure vibration monitoring equipment is correctly calibrated.
5. Ensure vibration level alarm and trip settings are correct.
6. Ensure vibration level trend is carefully monitored.

Given the limitations in our ability to inspect and examine the Nalcor sister unit at Hardwoods, the recommendations contained in this letter reflect our best attempts to assist you in assessing and overcoming the potential problems that may prevail on site and we trust that our recommendations are helpful.

In view of the conclusions drawn from the inspection on the Stephenville generator and the significant impact a retaining ring failure can have on both plant and the potential threat to personnel safety, our strong recommendation would be to replace the retaining rings during the current outage.

Given these limitations and recommendations, you will no doubt reach your own decisions as to the best course of action. Please feel free to contact the undersigned with questions or comments.

Sincerely,

Phil Pawson  
Technical Director – BTD  
BRUSH Group  
Business Phone: +44 (0) 1509 612196