

1 Q. Re: Upgrade Power Transformers Volume II (Tab 17)

2 At page 5, Hydro outlines that a DP number of less than 400 will be up for  
3 replacement within a three to five year window. It is noted that Hydro has chosen  
4 400 as the target to allow adequate time to plan a replacement for the 200  
5 threshold indicating near the end of service life is reached. Time for delivery of a  
6 power transformer is outlined to be approximately 18 to 24 months after receipt of  
7 an order. Does Hydro have any information as to the length of time a transformer  
8 typically reaches a DP number of 200 or less?

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11 A. From the information Hydro has, there is no predictable length of time within which  
12 a transformer typically reaches a DP number of 200 or less. This is essentially the  
13 end of life condition for power transformers and Hydro feels it will depend on a  
14 combination of the operating characteristics, such as the loading of the  
15 transformer, and the quality of the transformer oil. For example, an increased  
16 loading will result in an increased operating temperature, which will cause a faster  
17 deterioration of the cellulose paper insulation within the transformer. With  
18 exposure to oxygen in free breathing transformers (which is the case for the  
19 majority of Hydro's power transformer fleet), the oxygen inhibitor will eventually be  
20 depleted, resulting in the oil becoming more acidic and attacking the paper.  
21 Through this chemical attack process, the strength of the paper insulation can be  
22 weakened to the point at which the transformer will not have the mechanical  
23 strength remaining to survive an energization or a through fault. At this point in the  
24 transformer's life cycle, the oil analysis will show a DP number which will be  
25 approaching 200 or less.

- 1 Hydro believes that if one is able to intervene and slow down this process through
- 2 oil reclamation and adding new oxygen inhibitor, the transformer life can be
- 3 extended, which is essentially extending the age to reach a DP of 200.