

1 Q. Please provide for the record a copy of Hydro's *"Upgrade Circuit Breakers"* report
2 dated July 2012 which Liberty received on March 25, 2015.

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5 A. Please see PR-PUB-NLH-084 Attachment 1.

A REPORT TO
THE BOARD OF COMMISSIONERS OF PUBLIC UTILITIES

	Electrical
	Mechanical
	Civil
	Protection & Control
	Transmission & Distribution
	Telecontrol
	System Planning

Upgrade Circuit Breakers

July 2012

SUMMARY

This project involves the refurbishment and replacement of 66, 138 and 230 kV circuit breakers. This report presents the methodology used for determining when a circuit breaker will be refurbished or replaced for air blast, SF6, and oil circuit breakers.

Hydro has 182 circuit breakers that are rated at 66 kV or higher with the majority nearing a point in their lifecycle where refurbishment or replacement has to be completed. Hydro has developed a circuit breaker upgrade plan based on service age, condition and time since last refurbishment.

The refurbishment and replacement of circuit breakers is required to ensure system reliability and comply with legislation to remove PCB contaminated bushings from oil circuit breakers.

Upgrade Circuit Breakers

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1 INTRODUCTION

Hydro's Circuit Breaker Upgrading project is required to refurbish or replace circuit breakers. The majority of circuit breakers have been in service for more than 30 years. As they age, the risk of failure increases.

Hydro has 182 circuit breakers rated for voltages at 66 kv and above. Figure 1 provides the age distribution of all breakers by voltage class.

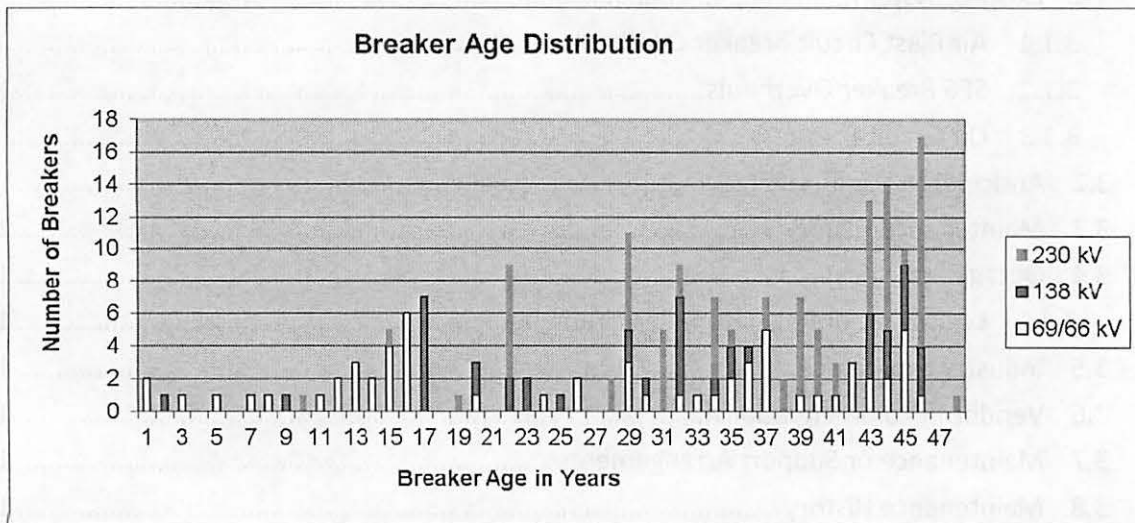


Figure 1: Breaker Age by Voltage Class

Circuit Breakers serve a critical function to the power system and are placed in terminal stations to perform switching actions to complete, maintain, and interrupt current flow under normal or fault conditions. Fast response and complete interruption are essential to protect the rest of the power system from a faulted component and maintain the stability of the system. Currently, Hydro maintains three different types of circuit breakers at 66 kV and above: Air Blast Circuit Breakers, Oil Circuit Breakers (OCB) and Sulphur Hexafluoride (SF6) Circuit Breakers. SF6 breakers are the newest design and are currently the only option for replacement for applications 66 kV and above.

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Each type of circuit breaker has unique operating characteristics. Air blast circuit breakers offer features such as fast response and automatic reclosing. They are widely used where repeated operation is essential. Unlike air blast breakers, which extinguish the arc using air as medium, oil circuit breakers extinguish the arc using insulating oil. SF6 circuit breakers use SF6 gas because of its highly reliable dielectric characteristics for arc extinguishing. The trend in the utility industry is towards SF6 breakers because of the superiority of the new technology and its operating characteristics.

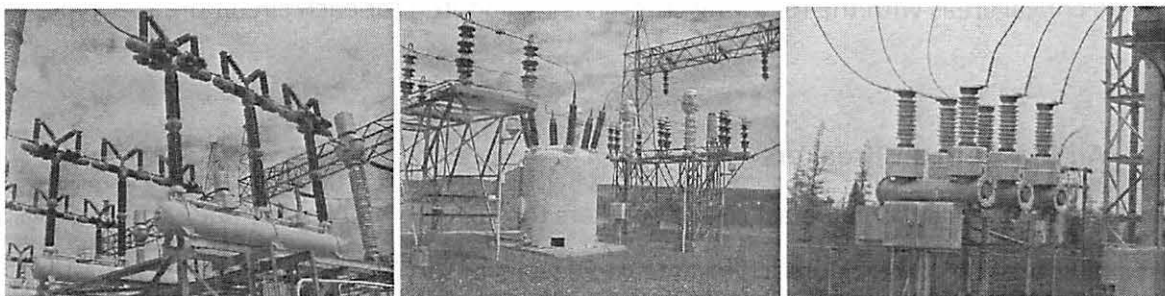


Figure 2: Circuit Breakers (Air Blast, Oil, and SF6; from left to right)

The basic components of a circuit breaker are the interrupting device (stationary contact, moving contact, arc quenching medium and insulating material) and the operating mechanism.

With air blast circuit breakers, both the interrupting device and operating mechanism require a mid-life overhaul of seals, O-rings, and lubrication. Oil circuit breakers require oil maintenance and possibly contact replacement, while SF6 breakers will typically only require an operating mechanism overhaul at mid-life as the interrupter is a sealed unit. However, for new high voltage circuit breakers, the only replacement option available on the market today is SF6 circuit breakers.

Oil circuit breakers will be replaced and not refurbished due to a legislative requirement to remove Polychlorinated Biphenyls (PCBs) which are contained in the OCB bushings.

2 PROJECT DESCRIPTION

With circuit breakers being a critical and a high-cost capital asset, Hydro, like many North American utilities, has been working to maximize the life of its service units. In recent years, Hydro has been upgrading air blast circuit breakers, overhauling operating mechanisms associated with SF6 breakers, and attempting to deal with the phase out of bushings containing polychlorinated byphenols (PCBs), such as those associated with OCBs. This project will address all three critical areas with the following criteria being adopted for each circuit breaker type.

2.1 Air Blast Circuit Breakers

Complete one overhaul on air blast circuit breakers through the breaker life and replace air blast circuit breakers after approaching at least 50 years of service and 10 and 15 years after overhaul. Depending upon breaker reliability, air blast breakers will be considered for replacement at the age of 50 years.

To help balance financial and human resources over time, exceptions to the above criteria will include:

- A. The Asea Brown Boveri (ABB) type DLF¹ breakers will have one breaker replaced at the age of 40 to facilitate the overhaul of remaining DLF type breakers. The parts from this breaker will be sent to the original equipment manufacturer (OEM), ABB, for overhaul and then installed on another breaker and the latter's parts will be shipped to the OEM for overhaul. This process will continue for the duration of the overhaul program which is currently planned to have three DLF type breakers overhauled per year starting in 2013, and continuing until 2019.

¹ DLF is a type number for breakers assigned by the manufacturer.

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B. Breakers will also be replaced if terminal stations are upgraded. The same is true for any circuit breaker upgrades required for the future development of the Labrador infeed.

C. Breakers will also be considered for replacement if their components have deteriorated such that it warrants replacement.

2.2 Oil Circuit Breakers

An oil circuit breaker will be scheduled for replacement prior to 2025. The existing oil circuit breakers have sealed bushings which potentially contain polychlorinated phenyls greater than 500 mg/kg.

2.3 SF6 Breakers

Complete one overhaul after 20 years for all new SF6 breakers and complete an overhaul between 20-30 years for existing in-service units. This approach was taken for existing units in service to help balance the financial and human resources, and to minimize outages to the power system. The plan for routine replacement will be after 40 years of service. Other breakers will be given consideration for replacement based upon their condition and operational history. For example, Hydro has replaced air operated SF6 breakers in recent years due to gas leaks, problems with the operating mechanism and corrosion of air receiver tanks. One 69 kV SF6 breaker was replaced in Howley in 2009 and one SF6 breaker was replaced in St. Anthony in 2011 and another at St. Anthony is scheduled to be replaced 2012. Also, one 138 kV SF6 breaker was replaced in Bottom Brook in 2010.

The main objective for this project is to take an overall strategic approach for all existing circuit breakers. This approach supports the corporate asset management philosophy, complies with current legislation and minimizes customer outages.

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It is important to note some items not included in the methodology of this plan are:

1. There are no 66 kV voltage class air blast circuit breakers included in this proposal; and
2. There will be no overhauls on 66 kV voltage class SF6 circuit breakers as replacement is more cost effective. These replacements will occur typically 40 years after being in service. The actual timing of replacement will be determined based on breaker condition.

3 JUSTIFICATION

As illustrated in Figure 1 of this report, 62 percent of Hydro's circuit breakers are greater than 30 years of age and 47 percent are greater than 35 years of age. In recent years, Hydro has been trying to address breaker overhauls and replacements through separate capital budget proposals. With an effort to bring a consistent and consolidated long term asset plan forward for circuit breakers it was decided to develop a plan for circuit breakers which will cover the following:

- Air blast Circuit Breaker Overhauls of DCF, DCVF and DLF breakers;
- SF6 Operating Mechanism Overhauls;
- Oil Circuit Breaker replacements to replace aging assets and comply with legislation (deal with possible PCB bushings);
- SF6 Breaker Replacements; and
- Air blast Circuit Breaker Replacements.

To maintain the reliability of in-service breakers, Hydro plans to address its aging circuit breakers. To help balance financial impacts and system outage constraints, Hydro has developed a circuit breaker long term asset management plan that will have air blast circuit breaker overhauled and their lives extended to at least 50 years, SF6 breakers overhauled to maintain a life of 40 years, and oil circuit breakers replaced to ensure compliance with PCB regulations.

3.1 Existing System

This project is required to overhaul or replace aging circuit breakers in service for Hydro.

Figure 3 shows the age distribution for Hydro's circuit breakers rated 66 kV and greater. These demographics highlight the following that will affect the future management of circuit breakers:

1. The average age of the overall population of circuit breakers is well past a breaker's midlife of 20 years and is fast approaching the manufacturers' specified design end-of-life of 40 years.
2. 61 breakers are already greater than 40 years of age.
3. In order to keep the age of these breakers below 40 years, 61 breakers would require immediate replacement with an additional five breakers being replaced annually. This approach would result in a significant cost and as a result an alternate plan for rehabilitation was considered.
4. With reliability not being a concern for Hydro's air blast circuit breaker fleet, Hydro feels air blast breakers life can be extended 10 to 15 years after overhaul and at least to the age of 50 years. SF6 breakers will be replaced after 40 years of service and all oil circuit breakers will be replaced by 2025 because of PCB contamination.

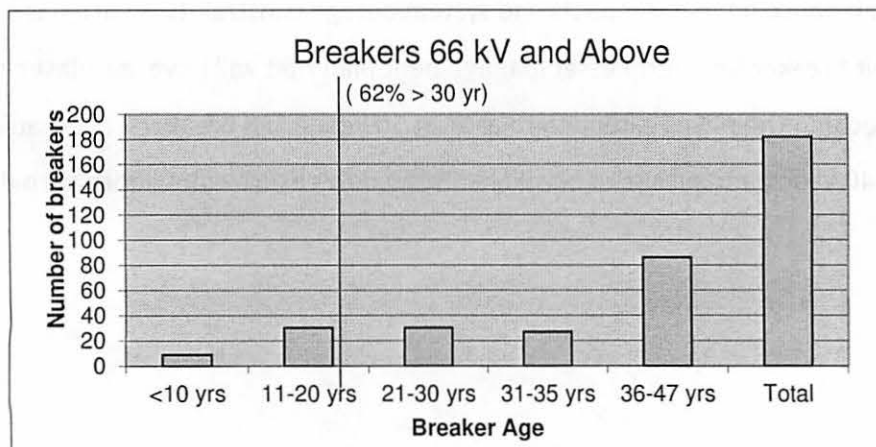


Figure 3: Circuit Breaker Age Distribution (66 kV and above)

In the past ten years there have been overhauls completed on air blast circuit breakers and the operating mechanism associated with selected SF6 Breakers. See Appendix D showing all overhauls completed prior to 2012.

3.1.1 Air Blast Circuit Breaker Overhauls

Since 1999, overhauls have been completed on air blast circuit breakers. By the end of 2012, it is expected, 40 of 66 breakers will have been overhauled. The current proposal will provide the funding to continue with this program to complete the remaining overhauls to extend breaker life from 40 to at least 50 years.

This project will also be the source for funding replacements of air blast breakers as they reach between 10 and 15 years past overhaul and an age of 50 years or greater. See Appendix A for the multi-year overhaul and replacement plans.

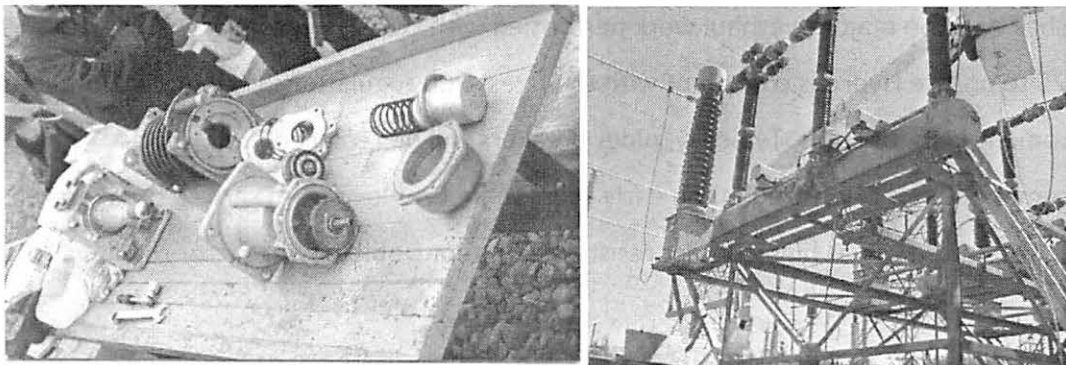


Figure 4: Air Blast Circuit Breaker during an Overhaul

3.1.2 SF6 Breaker Overhauls

In 2004, Hydro adopted a philosophy of overhauling operating mechanisms associated with 230 kV and 138 kV SF6 breakers. By the end of 2012 there will be 20 breakers overhauled. The plan is to complete three to four overhauls per year for a total of 37 by the end of 2017. See Appendix B for a list of SF6 breakers showing the next planned overhaul date and the planned replacement date.

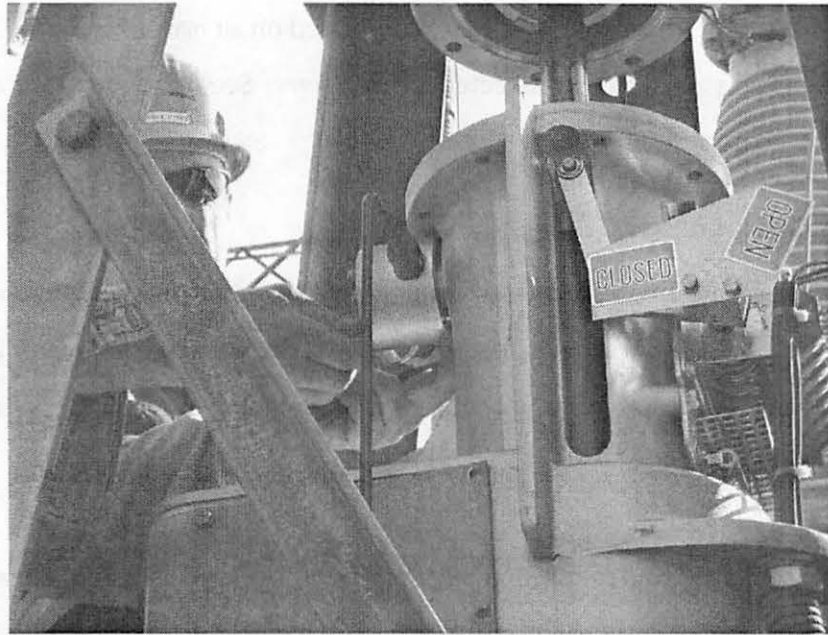


Figure 5: SF6 Breaker during an Overhaul

3.1.3 Oil Circuit Breakers

There has been no major overhaul work performed with OCBs. Hydro plans to replace all OCBs by 2025 to ensure Hydro is compliant with the latest PCB regulations. Appendix C outlines the replacement plan for OCBs. Typically, older breakers will be replaced first. However, the replacement plan is prioritized in the early years to first remove from service breakers with known problems such as high contact resistance or poor Doble power factor readings.

3.2 Anticipated Useful Life

With the current age of the existing circuit breaker fleet the lack of availability and failure of circuit breakers can be expected if refurbishment or replacement activities are not commenced. Hydro has been legislated to meet PCB Regulation targets for equipment containing PCBs such as bushings in OCBs. The status quo for 66 kV, 138 kV and 230 kV voltage class circuit breakers is not an option.

3.3 Maintenance History

For the purpose of determining how well an asset is performing Hydro will compare a particular asset against the national average of performance for that asset. This national average is based on a combination of data collected by the Canadian Electricity Association (CEA) which includes: forced outages, frequency of failure, and the availability of the asset. Table 1 lists the performance data for each criterion. The listed data is the performance averages for Hydro's circuit breaker asset over the previous five-years for 138 kV and 230 kV circuit breakers in comparison to the national average of 138 kV and 230 kV circuit breakers. The comparison uses the performance data from the latest CEA five year average data collected between 2006 through 2010.

3.4 Outage Statistics

From Table 1 below it should be noted that Hydro experienced 22 forced outages due to problems with these breakers over the last five years.

Table 1: Circuit Breaker Performance

	Number of Forced Outages	Frequency (per a) ¹	Unavailability (percent) ²
230 kV			
2006-2010	15	0.041	0.015
CEA (2006-2010)	592	0.062	0.230
138 kV			
2006-2010	7	0.036	0.001
CEA (2006-2010)	904	0.054	0.252
¹ Frequency (per a) is the number of failures per year ² Unavailability is the percent of time per year the unit is unavailable			

3.4.1 Legislative or Regulatory Requirements

The use of PCB material in oil circuit breaker bushings has presented an environmental issue which has led to the development of a plan for its removal and safe disposal. Prior to the mid 1980s the manufacturers of bushings used insulating oil containing PCBs with concentration

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varying from less than 2mg/kg to greater than 500mg/kg. The latest federal PCB Regulations (SOR/2008-273) provided an end of use date for different concentrations of PCBs. Section 16(1) states that the end of use for equipment containing PCBs in a concentration of 500 mg/kg or more was December 31, 2009; and for equipment containing PCBs in a concentration of at least 50 mg/kg but less than 500 mg/kg is December 31, 2025. The regulations also gave utilities an option to apply for an extension until 2014 to have all equipment containing greater than 500 mg/kg removed. Hydro, like other Canadian Electricity Association (CEA) members, has a significant amount of sealed equipment with unknown levels of PCBs. As a result, Hydro applied for and in 2010, was granted an extension until December 31, 2014.

Due to the large volume of equipment containing PCBs with varying and unknown levels of PCB concentration, CEA members including Hydro are actively pursuing a regulatory amendment to allow the use of bushings and instrument transformers with PCB concentrations of 500 mg/kg and greater until December 2025. This application presents a plan to meet a 2025 deadline, not a 2014 deadline. If this regulatory amendment is not granted, the capital investment required for oil circuit breaker replacements will have to increase significantly for 2014.

3.5 Industry Experience

Many utilities in North America are in a similar position as Hydro in that they have aging infrastructure and are seeking the most economic and reliable solution to refurbish and replace circuit breakers.

3.6 Vendor Recommendations

ABB, the OEM for the Air Blast Breakers, indicate that overhauling the units will extend the life of the unit for approximately 15 years. This will allow air blast breakers to have an anticipated useful life of at least 50 years. As result of this, Hydro plans to overhaul the remaining air blast circuit breakers and schedule their replacement 10 to 15 years after the overhaul and upon reaching an age of 50 years.

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The majority of the vendors for 138 kV and 230 kV SF6 breakers suggest the breakers are suitable for 40 years of operation provided an overhaul is completed near the mid life of the circuit breaker. Hydro has taken the approach to do this mid-life overhaul in a planned approach to minimize cost and outages to the system. The current plan is to overhaul three to four circuit breakers per year until 2017. Beyond 2017, overhauls will be planned after the breaker has been in service for 20 years.

3.7 Maintenance or Support Arrangements

For air blast circuit breaker overhauls, Hydro uses a common supplier for all for all overhaul parts associated with DCF type and DCVF type air blast breakers, and Hydro staff complete overhauls. This approach will continue for remaining DCF/DCVF type circuit breakers.

With respect to SF6 overhauls, Hydro has used ABB to assist with the overhaul of the ABB 230 kV ELF breakers and Siemens Canada Ltd. to direct the work associated with the overhaul of Siemens 230 kV 3AQ1 breakers.

The plan for the overhauls associated with DLF air blast circuit breakers, and 138 kV and 230 kV SF6 breakers will also be to partner with the OEM.

3.8 Maintenance History

For air blast breakers, Hydro has experienced problems with air leaks and valves sticking, resulting in increased maintenance costs and breaker unavailability. Such problems have mainly been a result of seals and O-rings deteriorating over time. The problems experienced by Hydro are common in the utility industry and owners of these types of air blast breakers have addressed the problem through similar upgrading programs. For example, Hydro One has chosen to complete a mid-life overhaul of their air blast circuit breakers after 20 to 25 years of service and are now considering the units for replacement after 40 to 50 years of service.

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The two main problems experienced with SF6 breakers have been gas leaks and operating mechanism malfunctions. Breaker B3L50 at Bottom Brook was replaced in 2010 due to gas leaks that were reoccurring and could not be repaired. Breaker L51T2 at Howley was replaced in 2009 due to severe corrosion of the receiver associated with the breaker.

With OCBs, the main problems experienced have been high contact resistance and poor oil condition. Both these factors are considered in prioritizing breakers for replacement.

The five-year maintenance history for circuit breakers is shown in Table 2.

Table 2: Five-Year Circuit Breaker Maintenance History

Year	Preventive Maintenance (\$000)	Corrective Maintenance (\$000)	Total Maintenance (\$000)
2011	61.8	160.3	222.1
2010	50.3	64.5	114.8
2009	15.0	46.0	61.0
2008	16.4	116.0	132.4
2007	7.7	121.0	128.7

3.9 Anticipated Useful Life

Circuit breakers are depreciated over a 55 year period. For replacement, 40 years will be the trigger point for SF6 type circuit breakers, while air blast circuit breakers will typically be replaced 10 to 15 years after overhaul and after the breaker reaches the age of 50 years.

Overhauls in the past 10 years have proven effective in maintaining the reliability of ABCBs and extending their lifecycle.

3.9.1 Development of Alternatives

The purpose of this project is to provide 66 kV, 138 kV and 230 kV circuit breakers that are reliable, cost effective, and are more environmental friendly. The three possible alternatives to

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achieve this goal are:

1. Replacement of all circuit breakers at the age of 40 years;
2. Refurbishment of failed circuit breakers as they occur; and
3. Replacement and refurbishment of circuit breakers in a planned strategic approach to balance financial and human resources and minimize outages.

3.9.2 Evaluation of Alternatives

1. Replacement of all circuit breakers at the age of 40 years: This alternative will require 61 breakers to be replaced immediately which will result in significant cost and will require outages to the system that will not be possible. As a result this alternative will not be pursued.
2. Refurbish failed circuit breakers as they occur: This is a run-to-failure approach and this philosophy is not prudent to maintain system reliability. A planned approach is required to ensure circuit breakers are overhauled or replaced at the appropriate time. Hydro does not plan to pursue this alternative.
3. Replacement and refurbishment of circuit breakers in a planned strategic approach to balance financial and human resources and outages to the power system:

In reviewing further Alternative 3, the only options to consider are overhaul versus replacement for air blast or SF6 breakers. The cost to overhaul a 230 kV air blast breaker is approximately one quarter the cost of replacement (estimated replacement of \$422,000), one week outage for an overhaul versus up to five weeks for replacements, and Hydro has seen high reliability from air blast breakers particularly those with high frequency of operations, such as generating unit breakers.

Overhauls for SF6 breakers are required to restore seals and wearing parts in the operating mechanism to achieve the service life expectation of 40 years. The cost to overhaul a 230 kV SF6 breaker is one seventh the cost of replacement (and one third the cost of replacing a 138

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kV breaker.) The system outage requirement for an overhaul is typically one week versus a four to five week outage for replacement.

It is not cost effective to refurbish 66 kV voltage class SF6 circuit breakers. Hydro has not considered any 66 kV air blast circuit breakers in this report. Due to PCB regulations all oil circuit breakers must be replaced instead of being refurbished.

As a result, Hydro will be pursuing Alternative 3 and using a two tiered approach involving both overhauls and replacements to help minimize system outages and take a more balanced financial and human resource approach.

4 CONCLUSION

Hydro plans to use a combination of overhauls and replacement for both Air Blast and SF6 breakers. The plan will see all current in-service air blast breakers replaced by 2031, all current in-service SF6 breakers overhauled at mid life and replaced at or near age 40, and all Oil Circuit Breakers replaced by 2023.

For air blast circuit breakers, there will be four to five overhauls completed per year. One breaker replacement will be completed in 2012 and three replacements per year for the next seven years. Further replacements will be required as outlined in the summary by replacement year outlined in Appendix E.

For SF6 breakers, there will be three to four overhauls completed per year and breaker replacements are not scheduled to begin until 2019 unless a breakers condition warrants replacement earlier. It should be noted, there are SF6 breakers identified in the Summary by Replacement year in Appendix E which have been approved on previous capital budget submissions.

For Oil Circuit breakers, there are three replacements scheduled per year starting in 2012 with the last OCB being replaced in 2023.

Table 3 summarizes the work plan for circuit breaker upgrading planned for the next five years and Hydro is requesting approval for the first five years of its multi-year plan with this submission.

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Table 3: Circuit Breaker Work Plan Summary 2013 to 2017 (Direct Costs)

	2013 (\$000)	2014 (\$000)	2015 (\$000)	2016 (\$000)	2017 (\$000)
Air Blast Breaker Overhauls	558	494	692	450	583
SF6 Breaker Overhauls	208	213	279	283	214
OCB Replacements	962	835	831	731	776
Air Blast Breaker Replacements	422	1,190	1,185	1,241	1,241
SF6 Breaker Replacements	0	0	0	0	0
Total	2,150	2,732	2,987	2,705	2,814

4.1 Budget Estimate

The 2013 budget estimate for this project is shown in Table 4.

Table 4: Budget Estimate

Project Cost:(\$ x1,000)	2013	2014	2015	2016	2017	Beyond	Total
Material Supply	570.0	1,000.0	1025.0	930.0	975.0	0.0	4,500.0
Labour	714.8	812.2	867.1	820.8	815.9	0.0	4,030.8
Consultant	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Contract Work	558.0	573.0	734.0	619.0	688.0	0.0	3,172.0
Other Direct Costs	324.5	363.8	378.4	351.5	351.5	0.0	1,769.6
Interest and Escalation	184.5	322.2	445.2	484.7	576.7	0.0	2,013.3
Contingency	433.5	549.8	600.9	544.2	566.1	0.0	2,694.5
TOTAL	2,785.3	3,621.0	4,050.6	3,750.1	3,973.2	0.0	18,180.2

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4.2 Project Schedule

The anticipated project schedule for each year is shown in Table 5.

Table 5: Project Schedule for Each Year

Activity		Start Date	End Date
Planning	Initial Planning	January 2013	February 2013
Design	Equipment Ordering Tendering	January 2013	February 2013
Procurement	Equipment Delivery	March 2013	August/September 2013
Construction	Equipment Installations	September 2013	November 2013
Commissioning	Installations in service	September 2013	November 2013
Closeout	Project Completion and Close Out	November 2013	December 2013

APPENDIX A

Air Blast Breakers Overhaul/Replacement Plan

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Appendix A*

Table A1 – Air Blast Breakers Overhaul/ Replacement Plan

LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
SSD TS	L03L06	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2001	2012	44
HWD TS	B1L36	Brown Boveri	Air Blast	DLF 245 nc2	1972	230	38	NA	2012	40
HWD TS	B1L01	Brown Boveri	Air Blast	DLF 245 nc2	1972	230	38	NA	2013	41
OPD TS	B1L18	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2008	2013	44
OPD TS	B1L36	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2008	2013	44
BDE TS1	B4B5	Brown Boveri	Air Blast	DCVF 245 mc6	1964	230	46	2003	2014	50
BDE TS1	B1T1	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2002	2014	48
BDE TS1	B3T6	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2000	2014	48
BDE TS1	B2T3	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	1999	2015	49
BDE TS1	B1T2	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	1999	2015	49
SSD TS	B1L03	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2002	2015	49
SSD TS	B1L02	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2003	2016	50
SSD TS	L02L07	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2003	2016	50
BDE TS1	B2T4	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2000	2016	48
BDE TS1	B3T5	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2000	2017	48
BDE TS1	B1B2	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2004	2017	51
MDR TS	B5L11	Brown Boveri	Air Blast	DCVF 245 mc6	1967	230	43	2006	2017	50
BDE TS1	B6B10	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2005	2018	50
WAV TS	B1L37	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2005	2018	50
BDE TS1	B2B3	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2006	2018	50

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Appendix A*

LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
MDR TS	B1L28	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2007	2019	53
STB TS	B1L31	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2008	2019	53
STB TS	L05L35	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2009	2019	53
STB TS	B1L35	Brown Boveri	Air Blast	DCF 245 mc6	1966	230	44	2010	2020	54
BDE TS1	B5B6	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2007	2020	52
WAV TS	B1L08	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2010	2020	52
STB TS	B2L04	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2011	2020	54
STB TS	B1L32	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2009	2021	53
STB TS	B3L22	Brown Boveri	Air Blast	DCF 170 mc4	1967	138	43	2011	2021	54
SSD TS	L06L07	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2011	2021	53

STB TS	L05L31	Brown Boveri	Air Blast	DCF 245 mc6	1969	230	41	2008	2021	52
WAV TS	L03L17	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2009	2022	53
WAV TS	B1L17	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2009	2022	53
SSD TS	B3T4	Brown Boveri	Air Blast	DCF 170 mc4	1966	138	44	2012	2022	56
STB TS	B3L130	Brown Boveri	Air Blast	DCF 170 mc4	1968	138	42	2012	2022	54
SSD TS	B2L12	Brown Boveri	Air Blast	DCF 170 mc4	1966	138	44	2012	2023	57
SSD TS	L19L100	Brown Boveri	Air Blast	DCF 170 mc4	1966	138	44	2012	2023	57
STB TS	B3T2	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2012	2023	54
SSD TS	L109T4	Brown Boveri	Air Blast	DCF 170 mc4	1968	138	42	2013	2023	55
SSD TS	B2T1	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2011	2024	55

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WAV TS	L01L03	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2011	2024	55
SSD TS	L100L10 9	Brown Boveri	Air Blast	DCF 170 mc4	1968	138	42	2013	2024	56
STB TS	B3L133	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2014	2024	55
BDE TS1	B3B4	Brown Boveri	Air Blast	DCVF 245 mc6	1972	230	38	2012	2025	53
HRD TS	B2L42	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2014	2025	52
BUC TS	L05L33	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2015	2025	52
STB TS	B3T1	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2015	2025	56
BBK TS	B1L11	Brown Boveri	Air Blast	DLF 245 nc2	1971	230	39	2013	2025	54
HRD TS	B2B11	Brown Boveri	Air Blast	DLF 245 nc2	1974	230	36	2015	2026	52
HRD TS	B1L17	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2015	2026	53
BDE TS1	B1B10	Brown Boveri	Air Blast	DCVF 245 mc6	1975	230	35	2015	2026	51
BUC TS	L28L32	Brown Boveri	Air Blast	DLF 245 nc2	1972	230	38	2013	2026	54
HRD TS	B1B11	Brown Boveri	Air Blast	DLF 245 nc2	1974	230	36	2016	2027	53
BBK TS	B1L09	Brown Boveri	Air Blast	DLF 245 nc2	1971	230	39	2013	2027	56
BUC TS	B1L05	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2014	2027	54
BUC TS	B1L28	Brown Boveri	Air Blast	DLF 245 nc2	1975	230	35	2016	2028	53
HRD TS	B12L17	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2014	2028	55
BBK TS	L09L33	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2016	2028	55
BBK TS	L11L33	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2017	2029	51
HRD TS	B3L18	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2018	2029	51
HRD TS	B12B15	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2018	2030	52
HRD TS	B3B13	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2018	2030	52
HRD TS	B12L42	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2019	2030	52

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WAV TS	B1B3	Brown Boveri	Air Blast	DLF 245 nc4	1977	230	33	2017	2031	54
STB TS	B3L10	Brown Boveri	Air Blast	DLF 145 nc2	1977	138	33	2017	2031	54
LHR TS	B3B4	Brown Boveri	Air Blast	DCVF 72.5 mc2	1968	46	42	2003	Not Required	44

APPENDIX B

SF6 Beaker Overhaul/Replacement Plan

*Upgrade Circuit Breakers
Appendix B*

Table B1 – Air Blast Breakers Overhaul/ Replacement Plan

LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
STA TS	B1T1	Westinghouse	SF6	690SP2500	1982	69	28	NA	2011	29
STA TS	B1L57	Westinghouse	SF6	690SP2500	1983	69	27	NA	2012	29
OPD TS	B5C1	Brown Boveri	SF6	ELF 72.5 n1rsv	1979	69	31	NA	2019	40
BUCTS	L32L33	Brown Boveri	SF6	ELF 245 n2s	1980	230	30	2006	2020	40
BDE TS2	B9L34	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2004	2020	39
HWD TS	B2L42	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2005	2020	39
DLK TS	B1L39	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2011	2021	41
HRD TS	B13B15	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2007	2021	40
HRD TS	B12L18	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2006	2021	40
USLTS	L34T1	Brown Boveri	SF6	ELF 245 nc2s	1981	230	29	2006	2021	40
DLK TS	B1L45	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2012	2022	42
HLY TS	B1L24	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2012	2022	42
HLY TS	B1L43	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2012	2022	42
DLKTS	B2L25	Westinghouse	SF6	690SP2500	1982	69	28	NA	2022	40
HLY TS	B1L45	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2013	2023	43
IRV TS	B1L363	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2013	2023	43
STA TS	B1L61	Westinghouse	SF6	690SP2500	1983	69	27	NA	2023	40
DLK TS	L39T2	Sprecher & Schuh	SF6	HGF 112/1C	1983	138	27	2013	2023	40
DLK TS	L45T2	Sprecher & Schuh	SF6	HGF 112/1C	1983	138	27	2014	2024	41
DLK TS	B3L47	Sprecher & Schuh	SF6	HGF 114/1A	1983	230	27	2014	2024	41
MDR TS	B1L48	Sprecher & Schuh	SF6	HGF 114/1A	1983	230	27	2014	2024	41
CAT TS	L47T1	Mitsubishi Electric Corp.	SF6	200-SFMT-40A	1984	230	26	2010	2024	40
CAT TS	L47T2	Mitsubishi Electric Corp.	SF6	200-SFMT-40A	1984	230	26	2010	2024	40
HLY TS	B1T2	Siemens	SF6	3 AR 1	1982	138	28	2015	2025	43
DLK TS	B3L48	Sprecher & Schuh	SF6	HGF 114/1A	1983	230	27	2015	2025	42
SVL TS	B1L09	S & C Electric	Circuit Switcher	Mark III	1983	230	27	2015	2025	42
WAV TS	B1T1	S & C Electric	Circuit Switcher	Mark III	1983	230	27	2015	2025	42
WAV TS	B1T2	S & C Electric	Circuit Switcher	Mark III	1983	230	27	2016	2026	43
GBK TS	L50L55	ASEA	SF6	HPL 145/25 A 1	1987	138	23	2016	2027	40
RWC TS	B1L57	Siemens	SF6	SP 72.5-23	1988	69	22	NA	2028	40

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LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
BBK TS	L14L50	S & C	Circuit Switcher	Model 2030	1989	138	21	2016	2029	40
BWT TS	L60T1	S & C	Circuit Switcher	Model 2030	1989	138	21	2017	2029	40
BHL TS	B1L59	ASEA Brown Boveri Inc.	SF6	HPL 145/20CI	1990	138	20	2017	2029	39
SSD TS	B3L19	Asea Brown Boveri	SF6	HPL 145/20C1	1990	138	20	2017	2029	39
WAV TS	L01L37	Siemens	SF6	3AQ1	1990	230	20	2004	2030	40
BDE TS2	B9B10	Siemens	SF6	3AQ1	1990	230	20	2011	2030	40
BDE TS2	B10B11	Siemens	SF6	3AQ1	1990	230	20	2009	2030	40
BDE TS2	B11L06	Siemens	SF6	3AQ1	1990	230	20	2004	2030	40
HRD TS	B12T10	Siemens	SF6	3AQ1	1990	230	20	2006	2031	41
STB TS	L04L32	Siemens	SF6	3AQ1	1990	230	20	2011	2031	41
BDE TS2	L06L34	Siemens	SF6	3AQ1	1990	230	20	2011	2031	41
HWD TS	B8B9	Siemens	SF6	SP 72.5-23-3	1992	69	18	NA	2032	40
IRV TS	B1L24	ASEA	SF6	HPL145/20C1	1992	138	18	2016	2032	40
IRV TS	B1L23	ASEA	SF6	HPL145/20C1	1992	138	18	2016	2032	40
HWD TS	B1B2	Sprecher Energie	SF6	BHG 114	1993	230	17	2011	2034	41
BCV TS	B1L56	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
BCV TS	B1R1	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
PBN TS	B1L41	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
PPT TS	B1L41	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
PPT TS	L41R1	AEG	SF6	DT145-F1	1995	138	15	2020	2036	41
PPT TS	L41R2	AEG	SF6	DT145-F1	1995	138	15	2020	2036	41
PPT TS	B1L44	AEG	SF6	DT145-F1	1995	138	15	2020	2036	41
DLK TS	B2L26	Siemens	SF6	SPS-72.5-23-1	1996	66	14	NA	2036	40
HRD TS	B7T5	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
HRD TS	B6T10	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
STA TS	B1C1	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
STA TS	B1C2	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
STA TS	B1C3	AEG	SF6	DT1-72F1	1996	69	14	NA	2038	42
BUC TS	B2T1	GEC Alsthom	SF6	DT1-72.5 F1	1997	69	13	NA	2038	41
BUC TS	B2L80	GEC Alsthom Canada	SF6	DT1-72F1	1997	69	13	NA	2038	41
MDR TS	B4T1	GEC Alsthom/ Cogenel AEG	SF6	DT1 72.5 F1	1997	69	13	NA	2038	41

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LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
PBN TS	B2T1	GEC Alsthom Canada	SF6	DT1-72F1	1997	69	13	NA	2039	42
CBC TS	B1B2	GEC Alsthom	SF6	HGF 114/1A	1997	230	13	2022	2039	42
PBN TS	B2L21	GEC Alsthom	SF6	DT1-72.5 F1	1998	69	12	NA	2039	41
RBK TS	L53T1	GEC-Alstom	SF6	DT1-72.5-1M	1998	69	12	NA	2039	41
HWD TS	B8C2	Siemens	SF6	FA220	1999	69	11	NA	2040	41
HWD TS	B8T4	Siemens	SF6	SPS2	1999	69	11	NA	2040	41
OPD TS	B2C2	Siemens	SF6	FA220	1999	69	11	NA	2040	41
OPD TS	B2T1	Alstom AEG	SF6	DT1-72.5 F1	2000	69	10	NA	2040	40
PBN TS	B2L62	Alstom AEG	SF6	DT1-72.5 F1	2000	69	10	NA	2041	41
CBF TS	252T	Alstom	SF6	DT1-72F1	2001	69	9	NA	2041	40
USL TS	L34L63	Alstom	SF6	HGF 1014IPO	2002	230	8	2027	2042	40
SOK TS	L22T1	Siemens	SF6	CPV2-145-25-1	2003	138	7	2028	2043	40
HWD TS	B7T2	Alstrom	SF6	DT1-72.5 F1	2004	69	6	NA	2044	40
BUC TS	B2L64	Areva T&D Inc.	SF6	DT-72.5 F1	2005	69	5	NA	2045	40
HWD TS	B7C1	Areva	SF6	DT1-72.5 F1	2007	69	3	NA	2047	40
HLY TS	L51T2	Areva	SF6	DT1-72.5 F1 FK	2009	69	1	NA	2049	40
BBKTS	B3L50	Areva	SF6	DT1-145-FK	2010	138	0	2035	2050	40
GBY TS	B1C1	Westinghouse	SF6	72.55 P22	1983	69	27	NA	Retire	

APPENDIX C

Oil Circuit Breaker Replacement Plan

*Upgrade Circuit Breakers
Appendix C*

Table C1 – Air Blast Breakers Overhaul/ Replacement Plan

LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
HBV TS	B1L21	CGE	Oil	KSO-69-1500	1970	66	40	NA	2011	41
BBK TS	B2L14	CGE	Oil	KSO-138-1500	1967	138	43	NA	2012	45
DLS TS	B1L15	CGE	Oil	KSO-69-1500	1967	66	43	NA	2012	45
MDR TS	B2T2	CGE	Oil	KSO-69-1500	1970	66	40	NA	2012	42
CBF TS	152T	CGE	Oil	KSO-69-1500	1966	66	44	NA	2013	47
BBK TS	L400T2	CGE	Oil	KSO-69-1500	1967	66	43	NA	2013	46
BDE TS2	B13L20	CGE	Oil	FKP	1975	66	35	NA	2013	38
HRD TS	B7L38	CGE	Oil	KSO-69-1500	1969	66	41	NA	2013	44
SPL TS	B1L23	CGE	Oil	KSO-138-1500	1967	138	43	NA	2014	47
BHL TS	L27T1	CGE	Oil	KSO-69-1500	1967	66	43	NA	2014	47
WAV TS	B2T1	CGE	Oil	KSO-69-1500	1967	66	43	NA	2014	47
SPL TS	B1L22	CGE	Oil	KSO-138-1500	1967	138	43	NA	2015	48
BHL TS	L26L27	CGE	Oil	KSO	1968	66	42	NA	2015	47
CHD TS	B1L27	CGE	Oil	KSO-69-1500	1970	66	40	NA	2015	45
DHR TS	B1L27	CGE	Oil	KSO-69-1500	1970	66	40	NA	2016	46
HWD TS	B7B8	CGE	Oil	FKP	1971	66	39	NA	2016	45
HWD TS	B7T1	CGE	Oil	FKP	1972	66	38	NA	2016	44
WAV TS	B2T2	CGE	Oil	FKP	1973	66	37	NA	2017	44
HVY TS	13-1	CGE	Oil	KSO-138-2500	1976	138	34	NA	2017	41
HRD TS	B7L2	CGE	Oil	KSO-69-1500	1969	66	41	NA	2017	48
SVL TS	B2L405	CGE	Oil	FKP	1975	66	35	NA	2018	43
WAV TS	B4L64	CGE	Oil	KSO	1977	138	33	NA	2018	41
SVL TS	L405T4	CGE	Oil	FKP	1975	66	35	NA	2018	43
HRD TS	B8L39	CGE	Oil	KSO-138-5000	1978	138	32	NA	2019	41
MDR TS	B3T3	CGE	Oil	FKP	1975	66	35	NA	2019	44
BDE TS2	B13T11	CGE	Oil	FKP	1976	66	34	NA	2019	43
HWD TS	B7T5	CGE	Oil	FKP	1976	66	34	NA	2020	44
SVL TS	B2T3	CGE	Oil	FKP	1975	66	35	NA	2020	45
WDL TS	B1L29	CGE	Oil	FKP	1976	66	34	NA	2020	44

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OPD TS	B5T3	CGE	Oil	FKP	1977	66	33	NA	2021	44
DLK TS	B2T1	CGE	Oil	FKP	1980	66	30	NA	2021	41
OPD TS	B2B5	CGE	Oil	FKP	1977	66	33	NA	2021	44
HRD TS	B6L3	CGE	Oil	FKP	1978	66	32	NA	2022	44
HWD TS	B8T3	ASEA	Min. Oil	HLC 72.5/2000	1986	66	24	NA	2022	36
OPD TS	B2T2	ASEA	Min. Oil	HLC 72.5/2000	1986	66	24	NA	2023	37
LHR TS	B3T1	CGE	Min. Oil	KSO-46-1500	1967	46	43	NA	Remove in 2012	45
SVL TS	L09L38	ASEA	Min. Oil	HLR 245/2505E2	1980	230	30	NA	Retire	30

APPENDIX D

Summary Overhaul Plan by Year

*Upgrade Circuit Breakers
Appendix D*

Table D1 – Air Blast Breakers Overhaul/ Replacement Plan

LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
BDE TS1	B2T3	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	1999	2015	49
BDE TS1	B1T2	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	1999	2015	49
BDE TS1	B3T6	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2000	2014	48
BDE TS1	B2T4	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2000	2016	48
BDE TS1	B3T5	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2000	2017	48
SSD TS	L03L06	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2001	2012	44
BDE TS1	B1T1	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2002	2014	48
SSD TS	B1L03	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2002	2015	49
BDE TS1	B4B5	Brown Boveri	Air Blast	DCVF 245 mc6	1964	230	46	2003	2014	50
SSD TS	B1L02	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2003	2016	50
SSD TS	L02L07	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2003	2016	50
LHR TS	B3B4	Brown Boveri	Air Blast	DCVF 72.5 mc2	1968	46	42	2003	Not Required	44
BDE TS1	B1B2	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2004	2017	51
BDE TS2	B9L34	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2004	2020	39
WAV TS	L01L37	Siemens	SF6	3AQ1	1990	230	20	2004	2030	40
BDE TS2	B11L06	Siemens	SF6	3AQ1	1990	230	20	2004	2030	40
BDE TS1	B6B10	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2005	2018	50
WAV TS	B1L37	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2005	2018	50
HWD TS	B2L42	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2005	2020	39
MDR TS	B5L11	Brown Boveri	Air Blast	DCVF 245 mc6	1967	230	43	2006	2017	50
BDE TS1	B2B3	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2006	2018	50
BUCTS	L32L33	Brown Boveri	SF6	ELF 245 n2s	1980	230	30	2006	2020	40
HRD TS	B12L18	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2006	2021	40
USLTS	L34T1	Brown Boveri	SF6	ELF 245 nc2s	1981	230	29	2006	2021	40
HRD TS	B12T10	Siemens	SF6	3AQ1	1990	230	20	2006	2031	41
MDR TS	B1L28	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2007	2019	53
BDE TS1	B5B6	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2007	2020	52
HRD TS	B13B15	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2007	2021	40
OPD TS	B1L18	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2008	2013	44
OPD TS	B1L36	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2008	2013	44
STB TS	B1L31	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2008	2019	53

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LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
STB TS	L05L31	Brown Boveri	Air Blast	DCF 245 mc6	1969	230	41	2008	2021	52
STB TS	L05L35	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2009	2019	53
STB TS	B1L32	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2009	2021	53
WAV TS	L03L17	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2009	2022	53
WAV TS	B1L17	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2009	2022	53
BDE TS2	B10B11	Siemens	SF6	3AQ1	1990	230	20	2009	2030	40
STB TS	B1L35	Brown Boveri	Air Blast	DCF 245 mc6	1966	230	44	2010	2020	54
WAV TS	B1L08	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2010	2020	52
CAT TS	L47T1	Mitsubishi Electric Corp.	SF6	200-SFMT-40A	1984	230	26	2010	2024	40
CAT TS	L47T2	Mitsubishi Electric Corp.	SF6	200-SFMT-40A	1984	230	26	2010	2024	40
STB TS	B2L04	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2011	2020	54
STB TS	B3L22	Brown Boveri	Air Blast	DCF 170 mc4	1967	138	43	2011	2021	54
SSD TS	L06L07	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2011	2021	53
SSD TS	B2T1	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2011	2024	55
WAV TS	L01L03	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2011	2024	55
DLK TS	B1L39	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2011	2021	41
BDE TS2	B9B10	Siemens	SF6	3AQ1	1990	230	20	2011	2030	40
STB TS	L04L32	Siemens	SF6	3AQ1	1990	230	20	2011	2031	41
BDE TS2	L06L34	Siemens	SF6	3AQ1	1990	230	20	2011	2031	41
HWD TS	B1B2	Sprecher Energie	SF6	BHG 114	1993	230	17	2011	2034	41
SSD TS	B3T4	Brown Boveri	Air Blast	DCF 170 mc4	1966	138	44	2012	2022	56
STB TS	B3L130	Brown Boveri	Air Blast	DCF 170 mc4	1968	138	42	2012	2022	54
SSD TS	B2L12	Brown Boveri	Air Blast	DCF 170 mc4	1966	138	44	2012	2023	57
SSD TS	L19L100	Brown Boveri	Air Blast	DCF 170 mc4	1966	138	44	2012	2023	57
STB TS	B3T2	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2012	2023	54
BDE TS1	B3B4	Brown Boveri	Air Blast	DCVF 245 mc6	1972	230	38	2012	2025	53
DLK TS	B1L45	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2012	2022	42
HLV TS	B1L24	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2012	2022	42
HLV TS	B1L43	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2012	2022	42
SSD TS	L109T4	Brown Boveri	Air Blast	DCF 170 mc4	1968	138	42	2013	2023	55

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LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
SSD TS	L100L109	Brown Boveri	Air Blast	DCF 170 mc4	1968	138	42	2013	2024	56
BBK TS	B1L11	Brown Boveri	Air Blast	DLF 245 nc2	1971	230	39	2013	2025	54
BUC TS	L28L32	Brown Boveri	Air Blast	DLF 245 nc2	1972	230	38	2013	2026	54
BBK TS	B1L09	Brown Boveri	Air Blast	DLF 245 nc2	1971	230	39	2013	2027	56
HLV TS	B1L45	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2013	2023	43
IRV TS	B1L363	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2013	2023	43
DLK TS	L39T2	Sprecher & Schuh	SF6	HGF 112/1C	1983	138	27	2013	2023	40
STB TS	B3L133	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2014	2024	55
HRD TS	B2L42	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2014	2025	52
BUC TS	B1L05	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2014	2027	54
HRD TS	B12L17	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2014	2028	55
DLK TS	L45T2	Sprecher & Schuh	SF6	HGF 112/1C	1983	138	27	2014	2024	41
DLK TS	B3L47	Sprecher & Schuh	SF6	HGF 114/1A	1983	230	27	2014	2024	41
MDR TS	B1L48	Sprecher & Schuh	SF6	HGF 114/1A	1983	230	27	2014	2024	41
BUC TS	L05L33	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2015	2025	52
STB TS	B3T1	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2015	2025	56
HRD TS	B2B11	Brown Boveri	Air Blast	DLF 245 nc2	1974	230	36	2015	2026	52
HRD TS	B1L17	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2015	2026	53
BDE TS1	B1B10	Brown Boveri	Air Blast	DCVF 245 mc6	1975	230	35	2015	2026	51
HLV TS	B1T2	Siemens	SF6	3 AR 1	1982	138	28	2015	2025	43
DLK TS	B3L48	Sprecher & Schuh	SF6	HGF 114/1A	1983	230	27	2015	2025	42
SVL TS	B1L09	S & C Electric	Circuit Switcher	Mark III	1983	230	27	2015	2025	42
WAV TS	B1T1	S & C Electric	Circuit Switcher	Mark III	1983	230	27	2015	2025	42
HRD TS	B1B11	Brown Boveri	Air Blast	DLF 245 nc2	1974	230	36	2016	2027	53
BUC TS	B1L28	Brown Boveri	Air Blast	DLF 245 nc2	1975	230	35	2016	2028	53

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LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
BBK TS	L09L33	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2016	2028	55
WAV TS	B1T2	S & C Electric	Circuit Switcher	Mark III	1983	230	27	2016	2026	43
GBK TS	L50L55	ASEA	SF6	HPL 145/25 A 1	1987	138	23	2016	2027	40
BBK TS	L14L50	S & C	Circuit Switcher	Model 2030	1989	138	21	2016	2029	40
IRV TS	B1L24	ASEA	SF6	HPL145/20C1	1992	138	18	2016	2032	40
IRV TS	B1L23	ASEA	SF6	HPL145/20C1	1992	138	18	2016	2032	40
BBK TS	L11L33	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2017	2029	51
WAV TS	B1B3	Brown Boveri	Air Blast	DLF 245 nc4	1977	230	33	2017	2031	54
STB TS	B3L10	Brown Boveri	Air Blast	DLF 145 nc2	1977	138	33	2017	2031	54
BWT TS	L60T1	S & C	Circuit Switcher	Model 2030	1989	138	21	2017	2029	40
BHL TS	B1L59	ASEA Brown Boveri Inc.	SF6	HPL 145/20CI	1990	138	20	2017	2029	39
SSD TS	B3L19	Asea Brown Boveri	SF6	HPL 145/20C1	1990	138	20	2017	2029	39
HRD TS	B3L18	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2018	2029	51
HRD TS	B12B15	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2018	2030	52
HRD TS	B3B13	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2018	2030	52
HRD TS	B12L42	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2019	2030	52
BCV TS	B1L56	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
BCV TS	B1R1	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
PBN TS	B1L41	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
PPT TS	B1L41	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
PPT TS	L41R1	AEG	SF6	DT145-F1	1995	138	15	2020	2036	41
PPT TS	L41R2	AEG	SF6	DT145-F1	1995	138	15	2020	2036	41
PPT TS	B1L44	AEG	SF6	DT145-F1	1995	138	15	2020	2036	41
CBC TS	B1B2	GEC Alsthom	SF6	HGF 114/1A	1997	230	13	2022	2039	42
USL TS	L34L63	Alstom	SF6	HGF 1014IPO	2002	230	8	2027	2042	40
SOK TS	L22T1	Siemens	SF6	CPV2-145-25-1	2003	138	7	2028	2043	40
BBKTS	B3L50	Areva	SF6	DT1-145-FK	2010	138	0	2035	2050	40

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LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
HWD TS	B1L36	Brown Boveri	Air Blast	DLF 245 nc2	1972	230	38	NA	2012	40
HWD TS	B1L01	Brown Boveri	Air Blast	DLF 245 nc2	1972	230	38	NA	2013	41
STA TS	B1T1	Westinghouse	SF6	690SP2500	1982	69	28	NA	2011	29
STA TS	B1L57	Westinghouse	SF6	690SP2500	1983	69	27	NA	2012	29
OPD TS	B5C1	Brown Boveri	SF6	ELF 72.5 n1rsv	1979	69	31	NA	2019	40
DLKTS	B2L25	Westinghouse	SF6	690SP2500	1982	69	28	NA	2022	40
STA TS	B1L61	Westinghouse	SF6	690SP2500	1983	69	27	NA	2023	40
RWC TS	B1L57	Siemens	SF6	SP 72.5-23	1988	69	22	NA	2028	40
HWD TS	B8B9	Siemens	SF6	SP 72.5-23-3	1992	69	18	NA	2032	40
DLK TS	B2L26	Siemens	SF6	SPS-72.5-23-1	1996	66	14	NA	2036	40
HRD TS	B7T5	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
HRD TS	B6T10	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
STA TS	B1C1	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
STA TS	B1C2	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
STA TS	B1C3	AEG	SF6	DT1-72F1	1996	69	14	NA	2038	42
BUC TS	B2T1	GEC Alsthom	SF6	DT1-72.5 F1	1997	69	13	NA	2038	41
BUC TS	B2L80	GEC Alsthom Canada	SF6	DT1-72F1	1997	69	13	NA	2038	41
MDR TS	B4T1	GEC Alsthom/ Cogenel AEG	SF6	DT1 72.5 F1	1997	69	13	NA	2038	41
PBN TS	B2T1	GEC Alsthom Canada	SF6	DT1-72F1	1997	69	13	NA	2039	42
PBN TS	B2L21	GEC Alsthom	SF6	DT1-72.5 F1	1998	69	12	NA	2039	41
RBK TS	L53T1	GEC-Alstom	SF6	DT1-72.5-1M	1998	69	12	NA	2039	41
HWD TS	B8C2	Siemens	SF6	FA220	1999	69	11	NA	2040	41
HWD TS	B8T4	Siemens	SF6	SPS2	1999	69	11	NA	2040	41
OPD TS	B2C2	Siemens	SF6	FA220	1999	69	11	NA	2040	41
OPD TS	B2T1	Alstom AEG	SF6	DT1-72.5 F1	2000	69	10	NA	2040	40
PBN TS	B2L62	Alstom AEG	SF6	DT1-72.5 F1	2000	69	10	NA	2041	41
CBF TS	252T	Alstom	SF6	DT1-72F1	2001	69	9	NA	2041	40
HWD TS	B7T2	Alstrom	SF6	DT1-72.5 F1	2004	69	6	NA	2044	40
BUC TS	B2L64	Areva T&D Inc.	SF6	DT-72.5 F1	2005	69	5	NA	2045	40

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LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
HWD TS	B7C1	Areva	SF6	DT1-72.5 F1	2007	69	3	NA	2047	40
HLV TS	L51T2	Areva	SF6	DT1-72.5 F1 FK	2009	69	1	NA	2049	40
GBY TS	B1C1	Westinghouse	SF6	72.55 P22	1983	69	27	NA	Retire	
HBV TS	B1L21	CGE	Oil	KSO-69-1500	1970	66	40	NA	2011	41
BBK TS	B2L14	CGE	Oil	KSO-138-1500	1967	138	43	NA	2012	45
DLS TS	B1L15	CGE	Oil	KSO-69-1500	1967	66	43	NA	2012	45
MDR TS	B2T2	CGE	Oil	KSO-69-1500	1970	66	40	NA	2012	42
CBF TS	152T	CGE	Oil	KSO-69-1500	1966	66	44	NA	2013	47
BBK TS	L400T2	CGE	Oil	KSO-69-1500	1967	66	43	NA	2013	46
BDE TS2	B13L20	CGE	Oil	FKP	1975	66	35	NA	2013	38
HRD TS	B7L38	CGE	Oil	KSO-69-1500	1969	66	41	NA	2013	44
SPL TS	B1L23	CGE	Oil	KSO-138-1500	1967	138	43	NA	2014	47
BHL TS	L27T1	CGE	Oil	KSO-69-1500	1967	66	43	NA	2014	47
WAV TS	B2T1	CGE	Oil	KSO-69-1500	1967	66	43	NA	2014	47
SPL TS	B1L22	CGE	Oil	KSO-138-1500	1967	138	43	NA	2015	48
BHL TS	L26L27	CGE	Oil	KSO	1968	66	42	NA	2015	47
CHD TS	B1L27	CGE	Oil	KSO-69-1500	1970	66	40	NA	2015	45
DHR TS	B1L27	CGE	Oil	KSO-69-1500	1970	66	40	NA	2016	46
HWD TS	B7B8	CGE	Oil	FKP	1971	66	39	NA	2016	45
HWD TS	B7T1	CGE	Oil	FKP	1972	66	38	NA	2016	44
WAV TS	B2T2	CGE	Oil	FKP	1973	66	37	NA	2017	44
HVY TS	13-1	CGE	Oil	KSO-138-2500	1976	138	34	NA	2017	41
HRD TS	B7L2	CGE	Oil	KSO-69-1500	1969	66	41	NA	2017	48
SVL TS	B2L405	CGE	Oil	FKP	1975	66	35	NA	2018	43
WAV TS	B4L64	CGE	Oil	KSO	1977	138	33	NA	2018	41
SVL TS	L405T4	CGE	Oil	FKP	1975	66	35	NA	2018	43
HRD TS	B8L39	CGE	Oil	KSO-138-5000	1978	138	32	NA	2019	41
MDR TS	B3T3	CGE	Oil	FKP	1975	66	35	NA	2019	44
BDE TS2	B13T11	CGE	Oil	FKP	1976	66	34	NA	2019	43
HWD TS	B7T5	CGE	Oil	FKP	1976	66	34	NA	2020	44
SVL TS	B2T3	CGE	Oil	FKP	1975	66	35	NA	2020	45
WDL TS	B1L29	CGE	Oil	FKP	1976	66	34	NA	2020	44

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LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
OPD TS	B5T3	CGE	Oil	FKP	1977	66	33	NA	2021	44
DLK TS	B2T1	CGE	Oil	FKP	1980	66	30	NA	2021	41
OPD TS	B2B5	CGE	Oil	FKP	1977	66	33	NA	2021	44
HRD TS	B6L3	CGE	Oil	FKP	1978	66	32	NA	2022	44
HWD TS	B8T3	ASEA	Min. Oil	HLC 72.5/2000	1986	66	24	NA	2022	36
OPD TS	B2T2	ASEA	Min. Oil	HLC 72.5/2000	1986	66	24	NA	2023	37
LHR TS	B3T1	CGE	Min. Oil	KSO-46-1500	1967	46	43	NA	Remove in 2012	45
SVL TS	L09L38	ASEA	Min. Oil	HLR 245/2505E2	1980	230	30	NA	Retire	30

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APPENDIX E

Summary Replacement Plan by Year

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Table E1 – Summary Replacement Plan by Year

LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
STA TS	B1T1	Westinghouse	SF6	690SP2500	1982	69	28	NA	2011	29
HBY TS	B1L21	CGE	Oil	KSO-69-1500	1970	66	40	NA	2011	41
SSD TS	L03L06	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2001	2012	44
HWD TS	B1L36	Brown Boveri	Air Blast	DLF 245 nc2	1972	230	38	NA	2012	40
STA TS	B1L57	Westinghouse	SF6	690SP2500	1983	69	27	NA	2012	29
BBK TS	B2L14	CGE	Oil	KSO-138-1500	1967	138	43	NA	2012	45
DLS TS	B1L15	CGE	Oil	KSO-69-1500	1967	66	43	NA	2012	45
MDR TS	B2T2	CGE	Oil	KSO-69-1500	1970	66	40	NA	2012	42
HWD TS	B1L01	Brown Boveri	Air Blast	DLF 245 nc2	1972	230	38	NA	2013	41
OPD TS	B1L18	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2008	2013	44
OPD TS	B1L36	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2008	2013	44
CBF TS	152T	CGE	Oil	KSO-69-1500	1966	66	44	NA	2013	47
BBK TS	L400T2	CGE	Oil	KSO-69-1500	1967	66	43	NA	2013	46
BDE TS2	B13L20	CGE	Oil	FKP	1975	66	35	NA	2013	38
HRD TS	B7L38	CGE	Oil	KSO-69-1500	1969	66	41	NA	2013	44
BDE TS1	B4B5	Brown Boveri	Air Blast	DCVF 245 mc6	1964	230	46	2003	2014	50
BDE TS1	B1T1	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2002	2014	48
BDE TS1	B3T6	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2000	2014	48
SPL TS	B1L23	CGE	Oil	KSO-138-1500	1967	138	43	NA	2014	47
BHL TS	L27T1	CGE	Oil	KSO-69-1500	1967	66	43	NA	2014	47
WAV TS	B2T1	CGE	Oil	KSO-69-1500	1967	66	43	NA	2014	47
BDE TS1	B2T3	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	1999	2015	49
BDE TS1	B1T2	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	1999	2015	49
SSD TS	B1L03	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2002	2015	49
SPL TS	B1L22	CGE	Oil	KSO-138-1500	1967	138	43	NA	2015	48
BHL TS	L26L27	CGE	Oil	KSO	1968	66	42	NA	2015	47
CHD TS	B1L27	CGE	Oil	KSO-69-1500	1970	66	40	NA	2015	45
SSD TS	B1L02	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2003	2016	50
SSD TS	L02L07	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2003	2016	50
BDE TS1	B2T4	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2000	2016	48
DHR TS	B1L27	CGE	Oil	KSO-69-1500	1970	66	40	NA	2016	46

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LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
HWD TS	B7B8	CGE	Oil	FKP	1971	66	39	NA	2016	45
HWD TS	B7T1	CGE	Oil	FKP	1972	66	38	NA	2016	44
BDE TS1	B3T5	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2000	2017	48
BDE TS1	B1B2	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2004	2017	51
MDR TS	B5L11	Brown Boveri	Air Blast	DCVF 245 mc6	1967	230	43	2006	2017	50
WAV TS	B2T2	CGE	Oil	FKP	1973	66	37	NA	2017	44
HVY TS	13-1	CGE	Oil	KSO-138-2500	1976	138	34	NA	2017	41
HRD TS	B7L2	CGE	Oil	KSO-69-1500	1969	66	41	NA	2017	48
BDE TS1	B6B10	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2005	2018	50
WAV TS	B1L37	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2005	2018	50
BDE TS1	B2B3	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2006	2018	50
SVL TS	B2L405	CGE	Oil	FKP	1975	66	35	NA	2018	43
WAV TS	B4L64	CGE	Oil	KSO	1977	138	33	NA	2018	41
SVL TS	L405T4	CGE	Oil	FKP	1975	66	35	NA	2018	43
MDR TS	B1L28	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2007	2019	53
STB TS	B1L31	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2008	2019	53
STB TS	L05L35	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2009	2019	53
OPD TS	B5C1	Brown Boveri	SF6	ELF 72.5 n1rsv	1979	69	31	NA	2019	40
HRD TS	B8L39	CGE	Oil	KSO-138-5000	1978	138	32	NA	2019	41
MDR TS	B3T3	CGE	Oil	FKP	1975	66	35	NA	2019	44
BDE TS2	B13T11	CGE	Oil	FKP	1976	66	34	NA	2019	43
STB TS	B1L35	Brown Boveri	Air Blast	DCF 245 mc6	1966	230	44	2010	2020	54
BDE TS1	B5B6	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2007	2020	52
WAV TS	B1L08	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2010	2020	52
STB TS	B2L04	Brown Boveri	Air Blast	DCVF 245 mc6	1966	230	44	2011	2020	54
BUCTS	L32L33	Brown Boveri	SF6	ELF 245 n2s	1980	230	30	2006	2020	40
BDE TS2	B9L34	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2004	2020	39
HWD TS	B2L42	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2005	2020	39
HWD TS	B7T5	CGE	Oil	FKP	1976	66	34	NA	2020	44
SVL TS	B2T3	CGE	Oil	FKP	1975	66	35	NA	2020	45
WDL TS	B1L29	CGE	Oil	FKP	1976	66	34	NA	2020	44
STB TS	B1L32	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2009	2021	53

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LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
STB TS	B3L22	Brown Boveri	Air Blast	DCF 170 mc4	1967	138	43	2011	2021	54
SSD TS	L06L07	Brown Boveri	Air Blast	DCVF 245 mc6	1968	230	42	2011	2021	53
STB TS	L05L31	Brown Boveri	Air Blast	DCF 245 mc6	1969	230	41	2008	2021	52
DLK TS	B1L39	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2011	2021	41
HRD TS	B13B15	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2007	2021	40
HRD TS	B12L18	Brown Boveri	SF6	ELF 245 n2s	1981	230	29	2006	2021	40
USLTS	L34T1	Brown Boveri	SF6	ELF 245 nc2s	1981	230	29	2006	2021	40
OPD TS	B5T3	CGE	Oil	FKP	1977	66	33	NA	2021	44
DLK TS	B2T1	CGE	Oil	FKP	1980	66	30	NA	2021	41
OPD TS	B2B5	CGE	Oil	FKP	1977	66	33	NA	2021	44
WAV TS	L03L17	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2009	2022	53
WAV TS	B1L17	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2009	2022	53
SSD TS	B3T4	Brown Boveri	Air Blast	DCF 170 mc4	1966	138	44	2012	2022	56
STB TS	B3L130	Brown Boveri	Air Blast	DCF 170 mc4	1968	138	42	2012	2022	54
DLK TS	B1L45	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2012	2022	42
HLV TS	B1L24	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2012	2022	42
HLV TS	B1L43	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2012	2022	42
DLKTS	B2L25	Westinghouse	SF6	690SP2500	1982	69	28	NA	2022	40
HRD TS	B6L3	CGE	Oil	FKP	1978	66	32	NA	2022	44
HWD TS	B8T3	ASEA	Min. Oil	HLC 72.5/2000	1986	66	24	NA	2022	36
SSD TS	B2L12	Brown Boveri	Air Blast	DCF 170 mc4	1966	138	44	2012	2023	57
SSD TS	L19L100	Brown Boveri	Air Blast	DCF 170 mc4	1966	138	44	2012	2023	57
STB TS	B3T2	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2012	2023	54
SSD TS	L109T4	Brown Boveri	Air Blast	DCF 170 mc4	1968	138	42	2013	2023	55
HLV TS	B1L45	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2013	2023	43
IRV TS	B1L363	Brown Boveri	SF6	ELF 145 nls	1980	138	30	2013	2023	43
STA TS	B1L61	Westinghouse	SF6	690SP2500	1983	69	27	NA	2023	40
DLK TS	L39T2	Sprecher & Schuh	SF6	HGF 112/1C	1983	138	27	2013	2023	40
OPD TS	B2T2	ASEA	Min. Oil	HLC 72.5/2000	1986	66	24	NA	2023	37
SSD TS	B2T1	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2011	2024	55
WAV TS	L01L03	Brown Boveri	Air Blast	DCVF 245 mc6	1969	230	41	2011	2024	55

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LOCATION	NLH ID	MFG	TYPE	MODEL	YEAR BUILT	OPER VOLT (kV)	CURRENT AGE	OVERHAUL YEAR	REPLACEMENT YEAR	AGE AT REPLACEMENT
SSD TS	L100L109	Brown Boveri	Air Blast	DCF 170 mc4	1968	138	42	2013	2024	56
STB TS	B3L133	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2014	2024	55
DLK TS	L45T2	Sprecher & Schuh	SF6	HGF 112/1C	1983	138	27	2014	2024	41
DLK TS	B3L47	Sprecher & Schuh	SF6	HGF 114/1A	1983	230	27	2014	2024	41
MDR TS	B1L48	Sprecher & Schuh	SF6	HGF 114/1A	1983	230	27	2014	2024	41
CAT TS	L47T1	Mitsubishi Electric Corp.	SF6	200-SFMT-40A	1984	230	26	2010	2024	40
CAT TS	L47T2	Mitsubishi Electric Corp.	SF6	200-SFMT-40A	1984	230	26	2010	2024	40
BDE TS1	B3B4	Brown Boveri	Air Blast	DCVF 245 mc6	1972	230	38	2012	2025	53
HRD TS	B2L42	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2014	2025	52
BUC TS	L05L33	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2015	2025	52
STB TS	B3T1	Brown Boveri	Air Blast	DCF 170 mc4	1969	138	41	2015	2025	56
BBK TS	B1L11	Brown Boveri	Air Blast	DLF 245 nc2	1971	230	39	2013	2025	54
HLV TS	B1T2	Siemens	SF6	3 AR 1	1982	138	28	2015	2025	43
DLK TS	B3L48	Sprecher & Schuh	SF6	HGF 114/1A	1983	230	27	2015	2025	42
SVL TS	B1L09	S & C Electric	Circuit Switcher	Mark III	1983	230	27	2015	2025	42
WAV TS	B1T1	S & C Electric	Circuit Switcher	Mark III	1983	230	27	2015	2025	42
HRD TS	B2B11	Brown Boveri	Air Blast	DLF 245 nc2	1974	230	36	2015	2026	52
HRD TS	B1L17	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2015	2026	53
BDE TS1	B1B10	Brown Boveri	Air Blast	DCVF 245 mc6	1975	230	35	2015	2026	51
BUC TS	L28L32	Brown Boveri	Air Blast	DLF 245 nc2	1972	230	38	2013	2026	54
WAV TS	B1T2	S & C Electric	Circuit Switcher	Mark III	1983	230	27	2016	2026	43
HRD TS	B1B11	Brown Boveri	Air Blast	DLF 245 nc2	1974	230	36	2016	2027	53
BBK TS	B1L09	Brown Boveri	Air Blast	DLF 245 nc2	1971	230	39	2013	2027	56

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BUC TS	B1L05	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2014	2027	54
GBK TS	L50L55	ASEA	SF6	HPL 145/25 A 1	1987	138	23	2016	2027	40
BUC TS	B1L28	Brown Boveri	Air Blast	DLF 245 nc2	1975	230	35	2016	2028	53
HRD TS	B12L17	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2014	2028	55
BBK TS	L09L33	Brown Boveri	Air Blast	DLF 245 nc2	1973	230	37	2016	2028	55
RWC TS	B1L57	Siemens	SF6	SP 72.5-23	1988	69	22	NA	2028	40
BBK TS	L11L33	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2017	2029	51
HRD TS	B3L18	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2018	2029	51
BBK TS	L14L50	S & C	Circuit Switcher	Model 2030	1989	138	21	2016	2029	40
BWT TS	L60T1	S & C	Circuit Switcher	Model 2030	1989	138	21	2017	2029	40
BHL TS	B1L59	ASEA Brown Boveri Inc.	SF6	HPL 145/20C1	1990	138	20	2017	2029	39
SSD TS	B3L19	Asea Brown Boveri	SF6	HPL 145/20C1	1990	138	20	2017	2029	39
HRD TS	B12B15	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2018	2030	52
HRD TS	B3B13	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2018	2030	52
HRD TS	B12L42	Brown Boveri	Air Blast	DLF 245 nc2	1978	230	32	2019	2030	52
WAV TS	L01L37	Siemens	SF6	3AQ1	1990	230	20	2004	2030	40
BDE TS2	B9B10	Siemens	SF6	3AQ1	1990	230	20	2011	2030	40
BDE TS2	B10B11	Siemens	SF6	3AQ1	1990	230	20	2009	2030	40
BDE TS2	B11L06	Siemens	SF6	3AQ1	1990	230	20	2004	2030	40
WAV TS	B1B3	Brown Boveri	Air Blast	DLF 245 nc4	1977	230	33	2017	2031	54
STB TS	B3L10	Brown Boveri	Air Blast	DLF 145 nc2	1977	138	33	2017	2031	54
HRD TS	B12T10	Siemens	SF6	3AQ1	1990	230	20	2006	2031	41
STB TS	L04L32	Siemens	SF6	3AQ1	1990	230	20	2011	2031	41
BDE TS2	L06L34	Siemens	SF6	3AQ1	1990	230	20	2011	2031	41
HWD TS	B8B9	Siemens	SF6	SP 72.5-23-3	1992	69	18	NA	2032	40
IRV TS	B1L24	ASEA	SF6	HPL145/20C1	1992	138	18	2016	2032	40
IRV TS	B1L23	ASEA	SF6	HPL145/20C1	1992	138	18	2016	2032	40

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HWD TS	B1B2	Sprecher Energie	SF6	BHG 114	1993	230	17	2011	2034	41
BCV TS	B1L56	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
BCV TS	B1R1	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
PBN TS	B1L41	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
PPT TS	B1L41	AEG	SF6	DT145-F1	1995	138	15	2020	2035	40
PPT TS	L41R1	AEG	SF6	DT145-F1	1995	138	15	2020	2036	41
PPT TS	L41R2	AEG	SF6	DT145-F1	1995	138	15	2020	2036	41
PPT TS	B1L44	AEG	SF6	DT145-F1	1995	138	15	2020	2036	41
DLK TS	B2L26	Siemens	SF6	SPS-72.5-23-1	1996	66	14	NA	2036	40
HRD TS	B7T5	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
HRD TS	B6T10	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
STA TS	B1C1	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
STA TS	B1C2	AEG	SF6	DT1-72F1	1996	69	14	NA	2037	41
STA TS	B1C3	AEG	SF6	DT1-72F1	1996	69	14	NA	2038	42
BUC TS	B2T1	GEC Alsthom	SF6	DT1-72.5 F1	1997	69	13	NA	2038	41
BUC TS	B2L80	GEC Alsthom Canada	SF6	DT1-72F1	1997	69	13	NA	2038	41
MDR TS	B4T1	GEC Alsthom/ Cogenel AEG	SF6	DT1 72.5 F1	1997	69	13	NA	2038	41
PBN TS	B2T1	GEC Alsthom Canada	SF6	DT1-72F1	1997	69	13	NA	2039	42
CBC TS	B1B2	GEC Alsthom	SF6	HGF 114/1A	1997	230	13	2022	2039	42
PBN TS	B2L21	GEC Alsthom	SF6	DT1-72.5 F1	1998	69	12	NA	2039	41
RBK TS	L53T1	GEC-Alstom	SF6	DT1-72.5-1M	1998	69	12	NA	2039	41
HWD TS	B8C2	Siemens	SF6	FA220	1999	69	11	NA	2040	41
HWD TS	B8T4	Siemens	SF6	SPS2	1999	69	11	NA	2040	41
OPD TS	B2C2	Siemens	SF6	FA220	1999	69	11	NA	2040	41
OPD TS	B2T1	Alstom AEG	SF6	DT1-72.5 F1	2000	69	10	NA	2040	40
PBN TS	B2L62	Alstom AEG	SF6	DT1-72.5 F1	2000	69	10	NA	2041	41
CBF TS	252T	Alstom	SF6	DT1-72F1	2001	69	9	NA	2041	40
USL TS	L34L63	Alstom	SF6	HGF 1014IPO	2002	230	8	2027	2042	40
SOK TS	L22T1	Siemens	SF6	CPV2-145-25-1	2003	138	7	2028	2043	40

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HWD TS	B7T2	Alstrom	SF6	DT1-72.5 F1	2004	69	6	NA	2044	40
BUC TS	B2L64	Areva T&D Inc.	SF6	DT-72.5 F1	2005	69	5	NA	2045	40
HWD TS	B7C1	Areva	SF6	DT1-72.5 F1	2007	69	3	NA	2047	40
HLY TS	L51T2	Areva	SF6	DT1-72.5 F1 FK	2009	69	1	NA	2049	40
BBKTS	B3L50	Areva	SF6	DT1-145-FK	2010	138	0	2035	2050	40
LHR TS	B3B4	Brown Boveri	Air Blast	DCVF 72.5 mc2	1968	46	42	2003	Not Required	44
LHR TS	B3T1	CGE	Min. Oil	KSO-46-1500	1967	46	43	NA	Remove in 2012	45
GBY TS	B1C1	Westinghouse	SF6	72.55 P22	1983	69	27	NA	Retire	
SVL TS	L09L38	ASEA	Min. Oil	HLR 245/2505E2	1980	230	30	NA	Retire	30