

1 Q. Further to PR-PUB-NLH-037, please provide justification for the \$26,600 spent on
2 overtime costs for overhauling Sunnyside breaker B1L03.

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5 A. For overall justification of the overhaul of Sunnyside B1L03, please refer to the
6 report: "UNFORESEEN ITEM: Sunnyside B1L03 230 kV Breaker Overhaul" submitted
7 to the Board on April 21, 2014 and attached as PR-PUB-NLH-063 Attachment 1.

8

9 Following the January 4, 2014 failure of Sunnyside breaker B1L03, the 230 kV ring
10 bus in Sunnyside was open and could not be closed without completing repairs to
11 B1L03. During the period it was left open, the power system was vulnerable to
12 significant outages if there was fault on transmission line TL202 or TL207, which
13 required those lines to be forced from service.

14

15 A fault on TL207 would have resulted in the loss of supply to the Avalon Peninsula
16 from TL202 as well as TL207. Under peak load conditions, this would cause
17 customer supply interruption. A fault on TL202 would have resulted in an outage to
18 the Burin Peninsula due to loss of supply to T4. Please refer to the attached single
19 line diagram attached as PR-PUB-NLH-063 Attachment 1.

20

21 In order to minimize the time for this exposure it was prudent to complete the
22 overhaul as safely and quickly as possible by having terminal station workers work
23 extended hours requiring overtime payments.

**A REPORT TO
THE BOARD OF COMMISSIONERS OF PUBLIC UTILITIES**

**UNFORESEEN ITEM:
Sunnyside B1L03
230 kV Breaker Overhaul**

April 2014

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1 INTRODUCTION

1.1 Background

On January 4, 2014, a 230 kV breaker at the Sunnyside (SSD) terminal station (TS) failed to open allowing a fault to remain on SSD T1 power transformer resulting in a transformer fire, a trip of all three units at the Holyrood Generating Station and outages to the Avalon and Burin peninsulas. The 230 kV breaker, SSD B1L03, is part of a 230 kV ring bus¹ configuration at SSD TS to provide reliability and maintainability for 230 kV breakers and the power grid on the Avalon. Transmission lines TL202, TL206, TL203 and TL207 all tie into the ring bus in SSD TS and having a breaker out of service for maintenance or due to a failure (providing that it is the only breaker out of service), will not affect the transmission capability to the Avalon (See Appendix A System Map). However, the power system integrity and vulnerability is affected with this open ring bus situation and with the possibility of another event, could result in undesired trips to additional equipment and a customer outage.

With the SSD B1L03 in a failed state, it was important to immediately plan to repair and overhaul this breaker and return it back to service as soon as practical. As a result, this was considered as unforeseen and urgent to repair and would require this breaker to be overhauled and put back into service. This was completed in January, 2014. The total cost of this overhaul, including parts and labor, is \$160,900.

1.2 Details on Failure of SSD B1L03

Sunnyside (SSD) terminal station, located on the Avalon Peninsula, contains a 230 kV ring bus that connects transmission lines TL202, TL206, TL203 and TL207 to the terminal station equipment such as power transformers SSD T1 and T4, breakers, current transformers, potential transformers, and insulators. In addition to supplying the Avalon and Burin peninsulas, the terminals station provides the means to connect the 138 kV loop from

¹ 230 kV Ring Bus – an arrangement of 230 kV breakers so that the failure of any one circuit breaker does not interrupt power to other circuits, and so that parts of the terminal station may be de-energized for maintenance and repairs.

Sunnyside (SSD) to Stony Brook (STB). See Appendix B for System Operating Diagram Sunnyside Terminal Station.

When SSD T1 faulted, the transformer protection operated and called upon breakers SSD B1L03, SSD B1L02, SSD B2T1, B3T4 and L109T4 to trip in order to isolate the transformer. All breakers opened as required, except SSD B1L03, which caused other breakers on the system to trip to clear the fault resulting in widespread customer outages on the Avalon and Burin Peninsulas and trips of all three units at Holyrood. During the restoration process on January 4, 2014 SSD B1L03 could not be reset or repaired immediately, resulting in an open ring bus in SSD TS.

The breaker was isolated from the ring bus and removed from service to further investigate. Upon closer inspection, it was deemed that the breaker would require an overhaul before it was released back to service to restore the ring bus.

2 PROJECT

2.1 Project Description

The project, to overhaul the 230 kV DCVF Asea Brown Broveri (ABB) air blast circuit breaker², was undertaken immediately following the investigation of the breaker components. The project was carried out by Hydro personnel and included removing the existing breaker heads, columns, control blocks, and control valves and replacing them. (See Appendix C for pictures of this breaker and components). Once the parts were replaced, the breaker was subjected to testing to ensure that it operated correctly. Once the testing and checks were completed, the breaker was released to Hydro's Energy Control Center (ECC) and put back into service.

² DCVF ABB Breaker – A common type of air blast circuit breaker that requires compressed air to operate the mechanisms and extinguish the internal arc during breaker operation.

2.2 Project Schedule

The following are the major milestones associated with the overhaul of breaker B1L03 at the SSD TS:

January 4, 2014	Breaker failed in service
January 5-28, 2014	Breaker overhaul completed
January 28, 2014	Breaker returned to service

2.3 Project Cost

The cost of the overhaul of breaker B1L03 at the SSD TS is summarized in Table 1.

Table 1: Project Final Cost

Category	Cost (\$ 000)
Labour	38.9
Overtime	26.6
Materials	72.1
Consultants	15.0
Travel	8.3
Total	\$160.9

3 JUSTIFICATION

After the events of January 4 and 5, 2014, when the power system experienced a number of equipment failures such as the transformer T1 fire in SSD TS, and Western Avalon transformer T5, SSD breaker B1L03 and Holyrood breaker B1L17 failures, it was important to proceed with the overhaul of SSD B1L03 as soon as practical to start bringing the system back to normal.

With SSD B1L03 in a failed state, resulting in an opened 230 kV ring bus, the system on the Avalon was vulnerable to another event which could result in additional equipment outages and significant customer impact. With that, the overhaul of SSD B1L03 began without delay to ensure the ring bus integrity was re-established.

4 CONCLUSION

On January 4, 2014, the 230 kV air blast circuit breaker SSD B1L03 failed to open, allowing a fault to remain on SSD T1 power transformer resulting in a transformer fire, a trip of all three units at the Holyrood generating station, and outages to the Avalon and Burin peninsulas.

With this failure and the potential of an extended outage to the breaker, the integrity of SSD TS ring bus was compromised and the transmission system to the Avalon and Burin peninsulas was vulnerable. Without delay, the 230 kV breaker was overhauled, tested and put back in service to ensure system reliability.

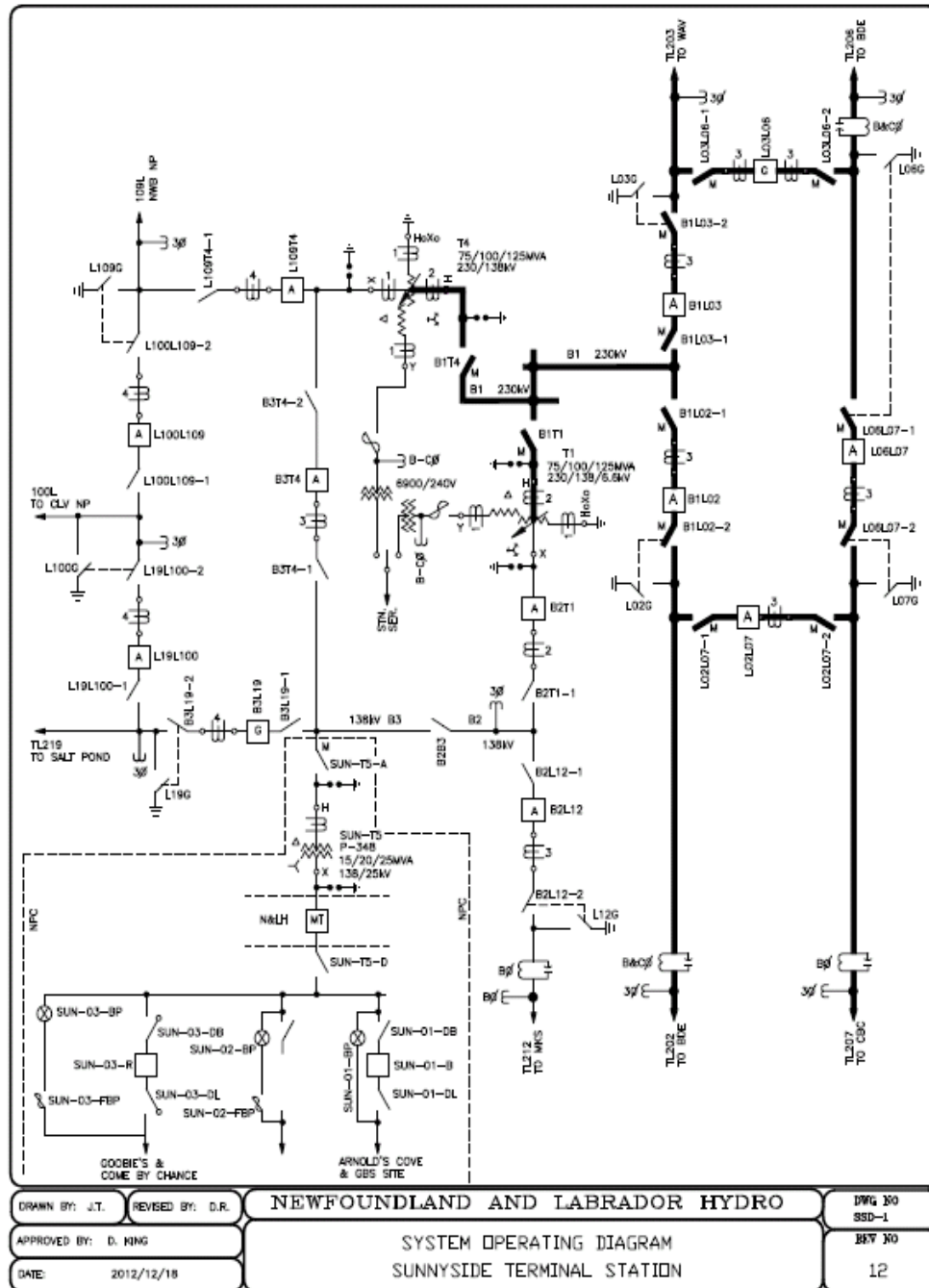
The 230 kV breaker overhaul is considered capital by nature and resulted in the use of the 2014 Allowance for Unforeseen Items. The total cost for the overhaul was \$160,900.

APPENDIX A

System Map

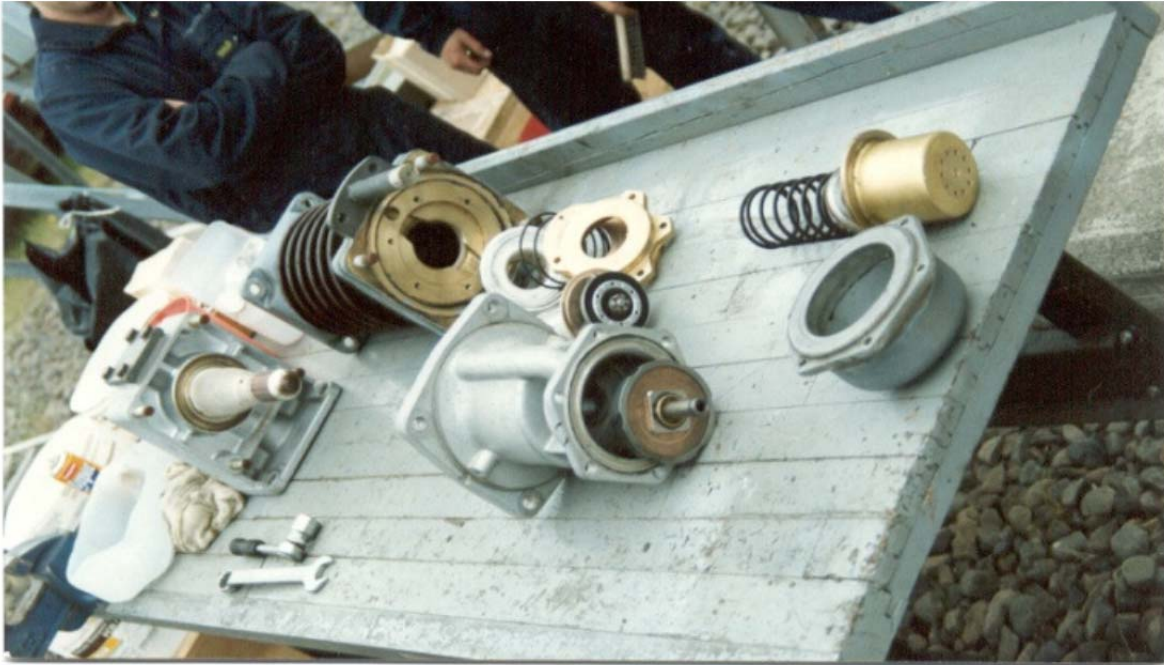


APPENDIX B
Sunnyside Terminal Station Single Line Diagram



APPENDIX C

Pictures



230 kV Breaker – DCVF during overhaul (Internal components)



230 kV Breaker – DCVF during overhaul



230 kV Breaker – DCVF in terminal station