

Fred James

Chief Regulatory Officer

Phone: 604-623-4046

Fax: 604-623-4407

bchydroregulatorygroup@bchydro.com

November 30, 2020

Ms. Marija Tresoglavic
Acting Commission Secretary and Manager
Regulatory Support
British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver, BC V6Z 2N3

Dear Ms. Tresoglavic:

**RE: British Columbia Utilities Commission (BCUC or Commission)
British Columbia Hydro and Power Authority (BC Hydro)
Vancouver Power Outage – November 4, 2020
BCUC Staff Questions**

BC Hydro writes to provide its responses to BCUC staff questions regarding a recent power outage on the west side of Vancouver that occurred on November 4, 2020 (**Outage**).

This response contains a detailed schematic of BC Hydro's substation facilities and information relating to the supply to customers and the operation of the electrical grid. For safety and security reasons, BC Hydro does not publicly disclose detailed technical information on its facilities. BC Hydro requests that the BCUC keep this response confidential pursuant to section 42 of the *Administrative Tribunals Act* and Part 4 of the BCUC's Rules of Practice and Procedure.

1.0 The circumstances and status of the grid leading up to the outage.

RESPONSE:

On the morning of the Outage, the BC Hydro grid was operating in a normal and reliable state. BC Hydro's domestic load was 6,830 MW and weather in Vancouver was sunny and mild (13° Celsius).

Sperling (SPG) substation is a 230 kV/12 kV facility that supplies power to about 62,000 customer accounts in the west-central Vancouver area. It is located at the southwest corner of Arbutus street and King Edward avenue ([Figure 1](#) and [Figure 2](#)). SPG substation also contains a 60 kV switchyard which was not involved in the Outage.

As shown in [Figure 1](#) and [Figure 2](#), the SPG substation is normally connected to the grid by three 230 kV underground circuits, 2L44, 2L45, and 2L64, which tie SPG substation to Mount Pleasant (MPT), Camosun (CSN), and Kidd 2 (KI2) substations respectively.

Figure 1 SPG Substation and Associated 230 kV Circuits

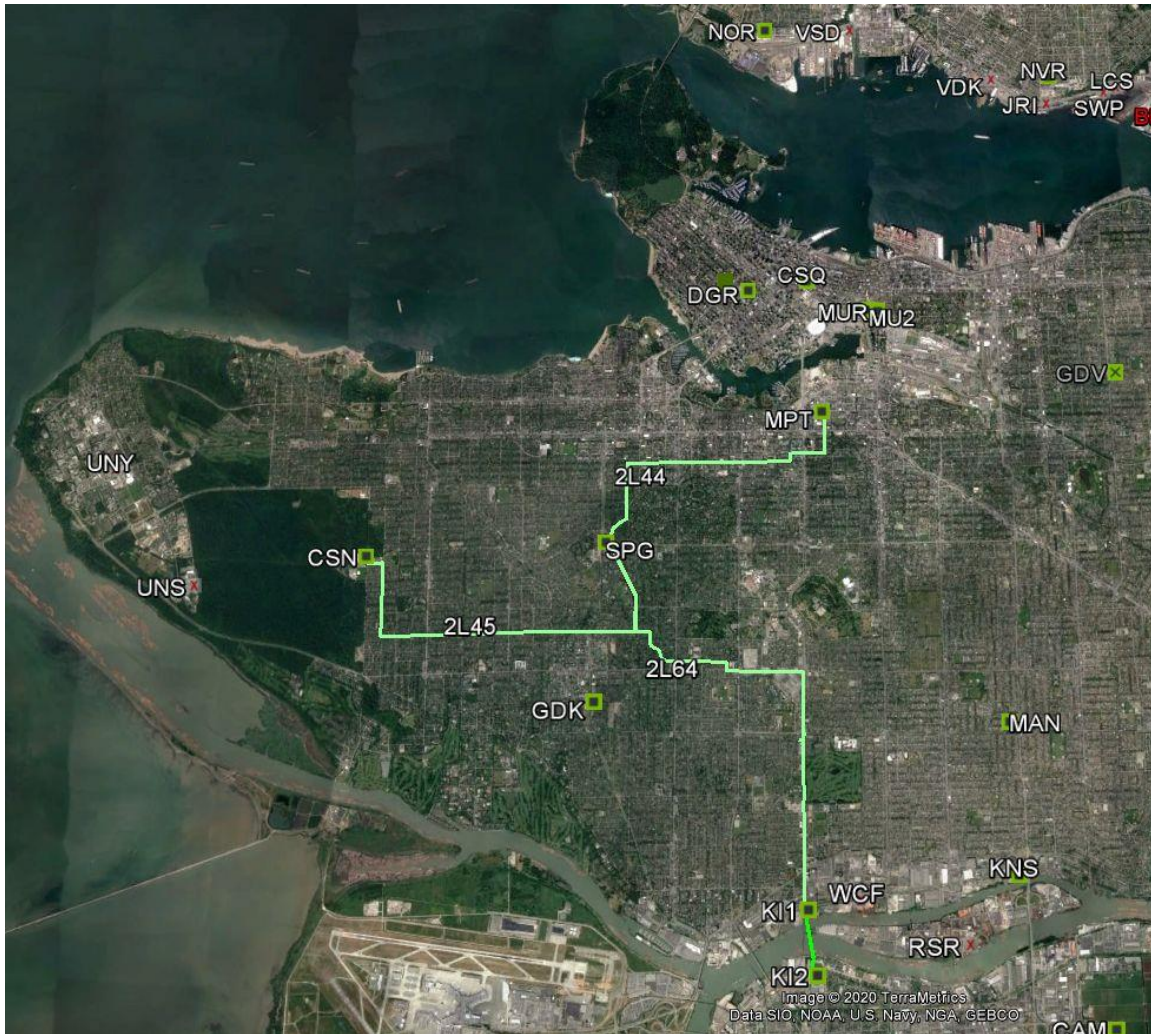
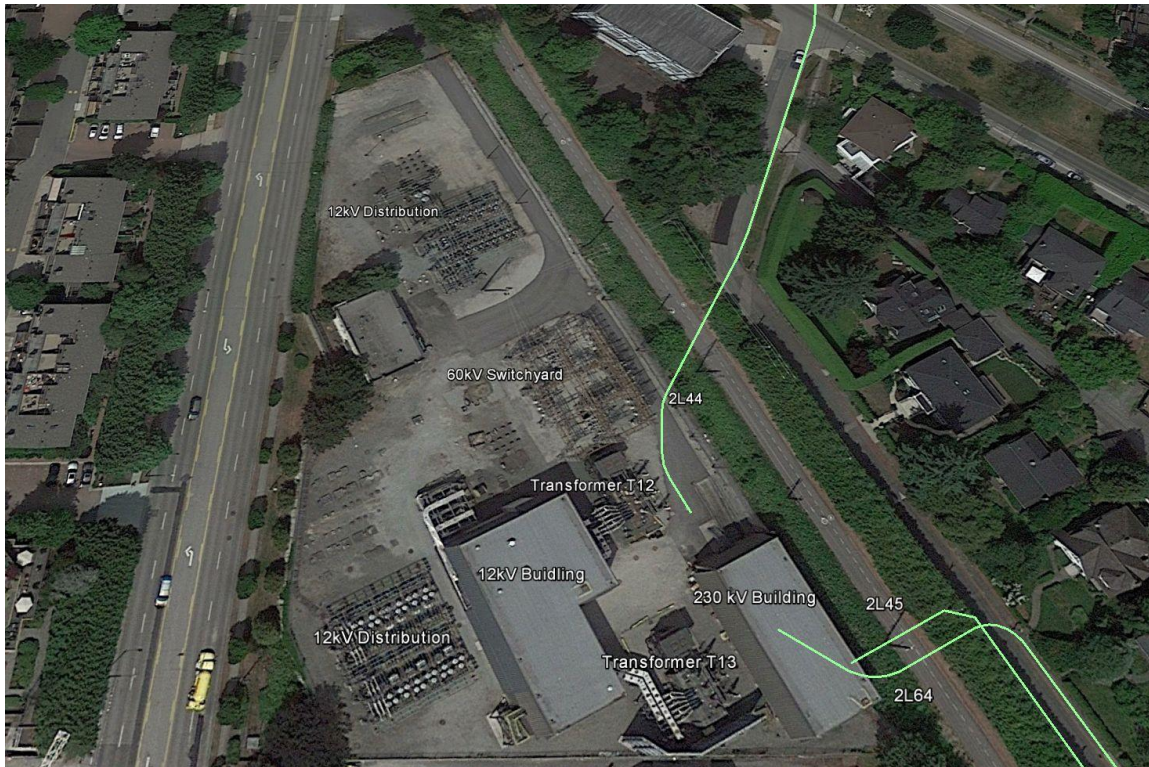


Figure 2 SPG Substation Layout and 230 kV Circuits 2L44, 2L45, and 2L64



On the morning of November 4, 2020, a planned outage of circuit 2L64 between KI2 and SPG substations was underway. This outage had started on November 2, 2020 and the purpose of the outage was to perform preventative maintenance on a 230 kV circuit breaker and disconnect switches at SPG substation. The planned outage was due to be completed on November 5, 2020. No customers were affected by the planned outage of circuit 2L64. There were no staff on site at SPG substation on the morning of November 4, 2020.

For safety reasons, and due to the SPG substation configuration, the isolation zone for this work included both circuit 2L64 and transformer T12, which were de-energized. The 230 kV circuit breakers 2CB1 and 2CB3 at SPG substation were also in an open state as part of the planned outage of circuit 2L64. Electricity supply to customers fed from SPG substation was via circuits 2L44 and 2L45 and transformer T13 to the 12 kV distribution network ([Figure 3b](#)).

[Figure 3a](#) shows in part, the substation Operating One Line Diagram of the SPG substation. [Figure 3b](#) shows the Energy Management System operating display just prior to the Outage. The yellow circled area in [Figure 3b](#) represents part of the substation that was out of service for the planned maintenance work.

Figure 3a SPG substation Operating One Line Diagram

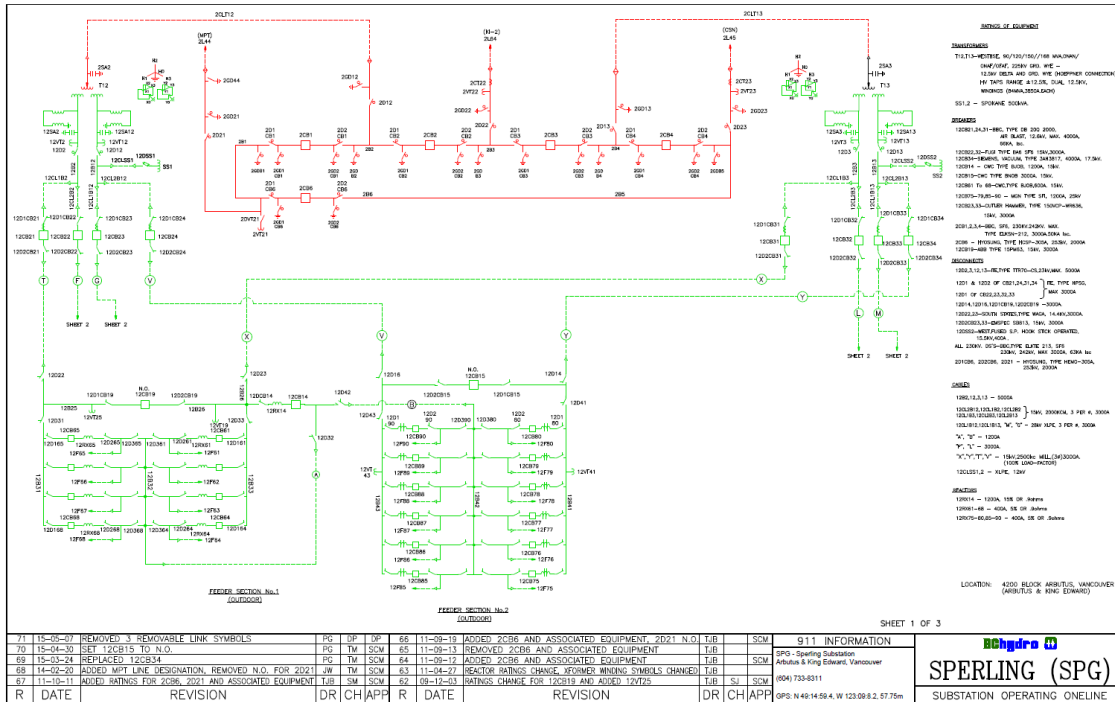
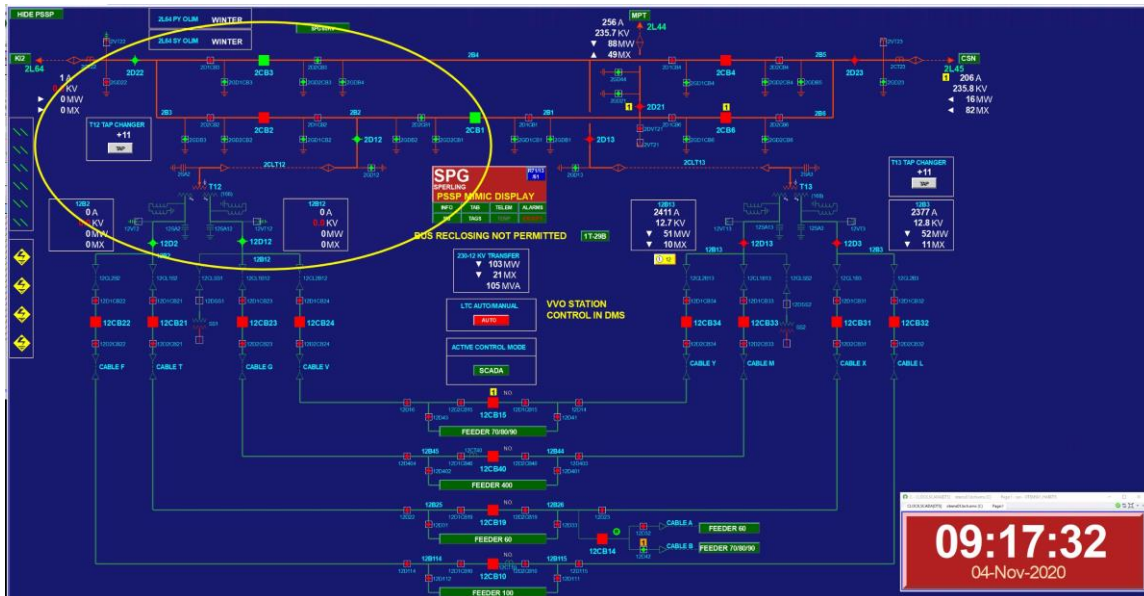


Figure 3b SPG substation Electrical Configuration Prior to Outage



Transformers T12 and T13 at SPG substation are each rated at 168 Megavolt Amperes (MVA). Immediately before the outage, transformer T12 was de-energized and transformer T13 was loaded to 105 MVA. The expected peak loading for the day was approximately 125 MVA.

2.0 A detailed description of the cause of the outage.

RESPONSE:

The root cause of the Outage has been determined to be human error.

On November 4, 2020, at 9:15 A.M. a system operator at the Fraser Valley Office (FVO) control center remotely opened circuit breaker 2CB4 at SPG substation. The intent of this action was to temporarily de-energize circuit 2L45 from SPG substation to CSN substation to allow switching to take place at CSN substation, but the unintended effect was to cause the Outage.

A disconnect switch at CSN substation needed to be opened for safety reasons to enable planned adjustments to another 230 kV disconnect switch and the safe installation of overhead lightning wire at CSN substation. For safety reasons this disconnect switch at the CSN substation could only be operated in a de-energized state. The location of this disconnect switch is in-line with the termination of circuit 2L45 at CSN substation.

The system operator's plan was to temporarily switch the circuit 2L45 out of service between SPG and CSN substations by opening circuit breaker 2CB4 at SPG substation, open the disconnect switch at CSN substation while it was de-energized, then switch circuit 2L45 back in service. During the brief outage to circuit 2L45, CSN substation would continue to be supplied via circuit 2L55 from Mainwaring (MAN) substation and the system operator believed that SPG substation customers would continue to be supplied via circuit 2L44 from MPT substation and transformer T13 at SPG substation.

The system operator at FVO mistakenly thought that transformer T13 at SPG substation would remain connected during the brief outage of circuit 2L45. However, due to the configuration of SPG substation, the action of opening circuit breaker 2CB4 at SPG substation caused transformer T13 at SPG substation to become disconnected from the grid, resulting in the Outage.

As shown in [Figure 3b](#), transformer T13 at SPG substation is connected between circuit breakers 2CB3 and 2CB4. Circuit breaker 2CB3 was already out of service for planned maintenance work of circuit 2L46. The system operator at FVO did not realize that opening circuit breaker 2CB4 at SPG substation would also have the unintended consequence of de-energizing transformer T13 and interrupting supply to all customers fed from SPG substation.

Figure 4 is a plot of the total electricity demand in MVA supplied by SPG substation between November 3, 2020 and November 4, 2020. The interruption in supply to customers can be seen in **Figure 4** starting at 9:17 A.M. and ending at 10:00 A.M. on November 4, 2020. The reason for the increased demand of approximately 20 per cent for 20 minutes after 10:00 A.M. is due to the phenomenon of “cold load pickup” as normally diverse and cyclic loads, such as space heating, all came on together at the same time.

Power was interrupted to 62,000 customer accounts in the Kerrisdale, Arbutus, Kitsilano, Shaughnessy, Cambie, and Fairview neighborhoods. **Figure 5** is a geographical representation of the extent of the Outage that was posted to BC Hydro’s website and social media accounts shortly after the Outage started. BC Hydro’s outage information webpage listed the cause of the Outage as a transmission circuit failure as initial attempts to restore the supply to SPG substation transformer T13 by closing circuit breaker 2CB4 were not successful.

Figure 4 Total MVA Demand at SPG Substation
(November 3, 2020 to November 4, 2020)

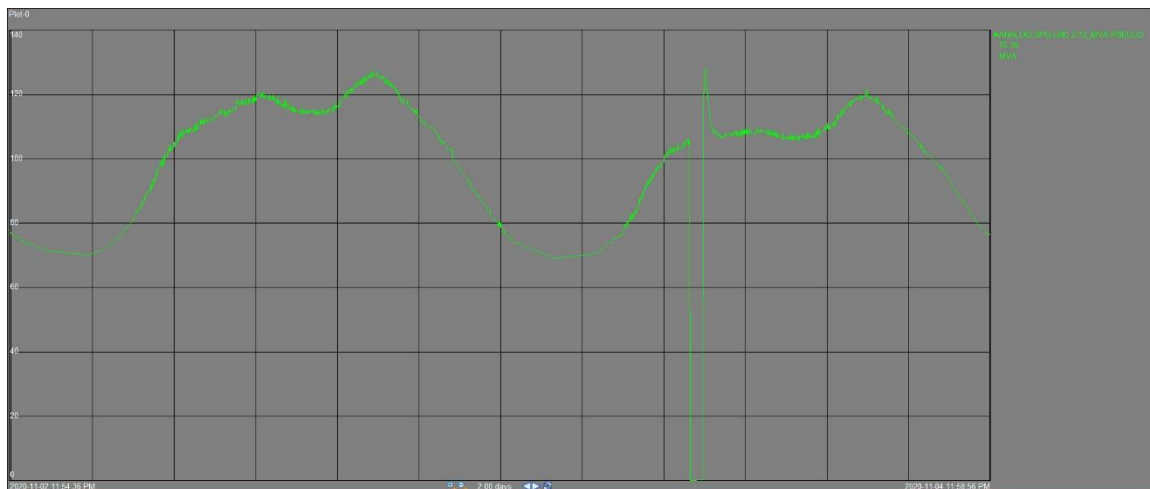
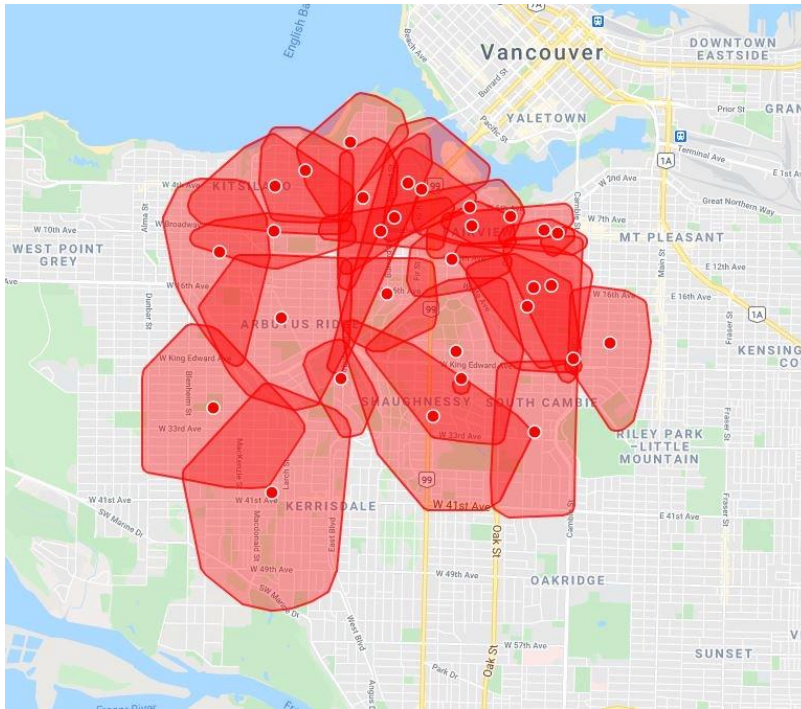


Figure 5 Geographic Extent of November 4, 2020 Outage



3.0 A description of the steps taken to repair the power failure.

RESPONSE:

The system operator at FVO immediately recognized that the switching had interrupted supply to customers fed from SPG substation. Normally the system operator at FVO would have immediately remotely closed the circuit breaker 2CB4 at SPG substation. However, this restorative action was not possible due to the total loss of power within the SPG substation.

An electrician working at CSN substation, approximately 3 km away from SPG substation, was dispatched to SPG substation at 9:25 A.M. after the attempts to remotely close circuit breaker 2CB4 were unsuccessful. The BC Hydro electrician arrived at SPG substation at 9:39 A.M. and immediately started troubleshooting work on circuit breaker 2CB4. The electrician was able to reset a relay that was preventing the remote closing of circuit breaker 2CB4. Once circuit breaker 2CB4 at SPG substation was closed, remote switching was performed by the system operator at FVO to restore supply to all customers fed from SPG substation by 10:00 A.M.

As noted above, the affected customers had been notified of the Outage via BC Hydro’s website and social media. Local media outlets also reported on the Outage, sharing the map of the Outage attached as [Figure 5](#).

4.0 A current status update and any potential future repairs that may be required

RESPONSE:

The current status is that electricity supply to all customers was restored and customers have continued to be served by SPG substation since the Outage. Both transformers T12 and T13 at SPG substation are currently back in service, with transformer T12 returned to service on November 5, 2020 at 11:13 A.M. Circuit 2L64 between SPG and KI2 substations remained out of service until November 13, 2020.

Since equipment failure was not a cause of this outage there are no future repairs required.

Following the Outage, and in accordance with BC Hydro’s safety related investigations, an interview was conducted with the system operator at FVO which led to the determination of human error. The system operator was following normal procedures with appropriate tools during the switching. However, the system operator at FVO misinterpreted the electrical drawing shown in [Figure 3b](#) and did not realize that opening circuit breaker 2CB4 at SPG substation would de-energize transformer T13. Had the system operator at FVO noticed this consequence they would have denied the request for the work at CSN substation to proceed at that time.

To ensure that similar events would not happen in the future, the system operator reviewed the job planning and outage scheduling processes for planned outages. BC Hydro will be reviewing the Outage and the policies and procedures with all other system operators at a future date.

Additionally, the Outage will be reviewed in system operator training seminars as part of BC Hydro’s goal to support reliability through analysis of events and corrective actions to prevent recurrence.

November 30, 2020
Ms. Marija Tresoglavic
Acting Commission Secretary and Manager
Regulatory Support
British Columbia Utilities Commission
Vancouver Power Outage – November 4, 2020
BCUC Staff Questions

For further information, please contact Anthea Jubb at 604-623-3545 or by email at bchydroregulatorygroup@bchydro.com

Yours sincerely,



Fred James
Chief Regulatory Officer

bf/ma