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February 20, 2020

Mr. Patrick Wruck
Commission Secretary and Manager
Regulatory Support
British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver, BC V6Z 2N3

Dear Mr. Wruck:

RE: British Columbia Utilities Commission (BCUC or Commission)
British Columbia Hydro and Power Authority (BC Hydro)
International Power Lines 5L51 and 5L52 – Canada Energy Regulator (CER)
Order for Electricity Reliability Standards – Compliance Verification
Activity Report: CV1617-026

BC Hydro is writing in response to the BCUC's letter, dated January 10, 2020, requesting an unredacted copy of the CER's "Compliance Verification Report: CV1617-026 – British Columbia Hydro and Power Authority" (the **Report**) that was issued regarding field inspections of International Powerlines 5L51 and 5L52 conducted in March 2017, and any associated reports received from the CER. The BCUC has also requested responses to three questions seeking further clarification regarding the issues raised in the Report.

On October 10, 2019 the CER issued its final version of the Report closing all items and considering them to be resolved. As noted at the top of the CER's email containing the final report:

> "If non-compliances were identified during the compliance activity, the officer considers them to be resolved. No further follow-up is required"

The final unredacted version of the Report[1] is provided as **Attachment 1** to this letter.

[1] Note that the email states that "A final copy of the compliance verification report for CV1617-026 is included at the end of this message". The body of the email constitutes this report.

Background

- On March 14 and March 15, 2017 the CER inspected International Power Lines 5L51 and 5L52 with BC Hydro. These powerlines cross the international border in South Surrey, British Columbia.
- On April 5, 2017 BC Hydro received a draft inspection report from the CER setting out the results of the inspection with requests for further information. This report was available to BC Hydro online while the CER inspection process was active. Now that the Report is closed it is no longer available online and BC Hydro does not have a copy. However, BC Hydro prepared responses to the Information Requests (**IR**s) which were filed on June 5, 2017; attached as **Attachment 2** to this letter.
- After reviewing the defects with Field Operations in fall of 2017, high-priority work was corrected immediately. Regular priority work was added to the next fiscal year's workplan (Fiscal 2019).
- During the time leading up to the issuance of the CER's final version of the Report found at Attachment 1, BC Hydro worked closely with the CER via email and had several teleconferences with them.
- On October 10, 2019 the CER issued its final version of the Report closing all items and considering them to be resolved. The CER also indicated that no further follow-up by BC Hydro is required.

BC Hydro's responses to the questions asked by the BCUC follow below:

BCUC Question 1

Please provide a response to the issues raised in the report, specifically addressing if any of these matters indicate a safety concern to either BC Hydro employees or members of the public in general?

BC Hydro's Response

Several of the defects identified by the CER were raised in the interest of public safety, namely having anti-climbing barriers and warning signs in areas frequented by members of the public. BC Hydro reviewed the structures identified, and in some cases agreed that due to the surrounding land use, such barriers were warranted, and so proceeded to install the barriers as discussed further below in BC Hydro's response to BCUC Question 3.

None of the matters observed by the CER were a safety concern to BC Hydro employees; they were treated as routine maintenance items.

Please refer to BC Hydro's response to the CER IRs (Attachment 2) for BC Hydro's response to the issues raised in the report.

BCUC Question 2

Please address if relevant CSA standards related to these matters have been adopted by BC Hydro. If not, please explain why. If they have, please explain why these matters were raised by the CER and if they indicate a breach of a standard?

BC Hydro's Response

None of the issues raised by the CER constitutes a breach by BC Hydro of a Canadian Standards Association (**CSA**) standard.

CSA standards relevant to the matters raised in the Report have been met. In all cases BC Hydro's standards meet or exceed CSA standards.

The section of CSA 22.3 that addresses anti-climbing barriers specifically requires these to be installed near schools and playgrounds, and that in other areas step-bolts are to be removed from the bottom three meters of the structures, so that they cannot be climbed without special means. BC Hydro also installs anti-climbing barriers and signage in areas where any routine public gathering is observed, or where the public frequent, such as the parking lots of shopping areas.

Land use changes over time, and for the specific towers identified in the CER inspection, the land use in the South Surrey area has undergone extensive urban densification, so barriers were installed. As set out below in BC Hydro's response to BCUC question 3, all work is completed as planned.

BCUC Question 3

Please describe what actions have been taken in response to any indicated deficiencies in the subject CER report.

BC Hydro's Response

Since receiving the draft inspection report and subsequent final version of the Report closing all items, BC Hydro has worked closely with the CER to communicate with and resolve the indicated deficiencies.

The actions BC Hydro has taken to resolve the issues are outlined below. Each numbered item below is an action identified in the CERs IR (Attachment 2).

1) iii. In almost all of the towers that were inspected, the High Voltage Danger signage was missing. This is not generally consistent with the safety requirements of section 4.2.5 CSA Code C22.3 No. 15

Action:

BC Hydro informed the CER on August 8, 2019 that the work was completed as planned. BC Hydro Field Operations patrolled the entire line and signage has been installed on all towers on both 5L51 and 5L52.

1) iv. Some towers close to the residential areas were not fenced, had no anti-climbers and were easily accessible to the public. This is not generally consistent with the safety requirements of section 4.2.5 CSA Code C22.3 No. 15 and was discussed with the company.

Action:

BC Hydro informed the CER on August 8, 2019 that all work was completed as planned. BC Hydro Field Operations patrolled the entire line and barriers and signs have been installed where required.

2) i. Two sets of 129V DC battery banks were observed– Primary and Back up. The primary battery system is a flooded lead-acid KCR-11 type 129VDC battery bank from C&D Technologies and they were installed in 1992; the average life expectancy of the VRLA batteries appears to have been exceeded, and the replacement schedule was discussed with the company. BC Hydro is to provide to the NEB a timeline by 21 April 2017 when the Primary battery bank will be replaced.

Action:

BC Hydro informed the CER on August 19, 2019 that the battery bank was replaced on March 14, 2018.

2) ii. The electrolyte levels were found to be okay. They are visually inspected by BC Hydro staff quarterly. Each cell's voltages are tested annually. Information on load test was not provided. BC Hydro is to provide to the NEB sample test results of the load test last performed on the primary and the backup battery banks by 28 April 2017.

Action:

BC Hydro stated on page 4 and 5 of its responses to the CER IRs (Attachment 2): "The Discharge Capacity Test (load test) for flooded lead-acid batteries is performed at 18 years. In this case, the 2011 discharge capacity test data for Ingledow primary battery bank cannot be located. The discharge capacity test from November 2000 for the Ingledow secondary battery bank is ING Batt#2 Discharge Capacity Test Record. Subsequent to this inspection, a verification process has been implemented to ensure test data is recorded consistently in a central location."

3) iv. 02-02 (51): Angle structure, no guy wire, next to the pathway. The condition of the tower, conductors, and the insulator strings is fine. Cathodic protection on the tower footing is buried under mounds of soil. Signage is there but no anti-climber. BC Hydro will provide the rationale to the NEB by 28 April 2017 why no anti-climber or fence has not been installed for the tower that is so close to the pathway. The tower marking was missing.

Action:

BC Hydro informed the CER on August 19, 2019 that an anti-climber barrier was installed.

4) i. 03-02 (51, 52): towers are standing within a confined yard of a house. The owner used his key to for us to enter through the property. The tower, conductor and insulators are fine. It is an angle tower. However, plenty of debris were observed under the tower that belongs to the 51 line. It's recorded in the BC Hydro deficiency list, and it was observed that the deficiency list suggested its removal in November 2014. BC Hydro will inform the NEB by 21 April 2017 when it will remove the debris.

Action:

BC Hydro informed the CER on August 8, 2019 that field Operations will continue to monitor the site. If an emerging need arises BC Hydro can exercise the removal option.

4) v. 06-05 (52): The tower footings for both 51 and 52 lines have concrete pads. The concrete pads for the 52 line have cracked in few places. It is already marked in the deficiency list, but it is recorded for 51 line. BC Hydro is recommended to verify if the deficiency was marked correctly. BC Hydro is to monitor the degradation of the base.

BC Hydro stated on page 6 of its responses to the CER IRs (Attachment 2): "Based on the assigned Condition Assessment Value (CAV), BC Hydro will not carry out any special monitoring or inspections as the condition is that of normal wear over the years. As part of our civil hazard inspections carried out by competent geotechnical and foundation engineers, we will continue to review this site as a normal instance for all sites with concrete or other foundation types."

4) vi. 7-04 (51): Bent steel in all A, B, C, legs of the tower were recorded in the deficiency list. No evidence of bent steel was observed. The report was from 06/11/01. It might have been repaired already, but no record of the repair was captured in the list. BC Hydro is to verify and confirm to the NEB by 21 April, 2017 when the concrete pads were repaired.

Action:

BC Hydro informed the CER on August 21, 2019 that the maintenance tracking system STARR (System for Transmission Asset Recording & Reporting) is a legacy system and BC Hydro is working with its Information Technology group to improve future record keeping as work is completed.

4) vii. 8-03 (52): The tower is fenced as there are communication equipment installed on top of the tower. Control instrumentations have been installed within the fenced perimeter of the tower. All elements of the transmission system were observed to be in good shape except one cross member which was found slightly bent. No signage was observed. BC Hydro is to inform to the NEB by 21 April 2017 when it will repair the cross member.

BC Hydro stated on page 7 of its responses to the CER IRs (Attachment 2): "This defect would not trigger an immediate repair or replacement request. However we will continue to monitor and may replace upon opportunity."

4) viii. 09-01 (51): The tower is not fenced and it is readily accessible from the adjacent pathway in the nearby residential area. The tower 9-01 (52) has communication equipment installed on top of the tower and it is fenced. However, no anti-climber was observed for the 9-01 (51) line. BC Hydro is to confirm to the NEB by 28 April 2017 that 9-01 (51) tower is safe from unauthorized access. Danger sign was observed on the tower.

Action:

BC Hydro informed the CER on August 8, 2019 that all work was completed as planned. BC Hydro Field Operations patrolled the entire line and anti-climbing barriers were added as necessary.

4) x. 09-03 (52): The tower is located next to a residential area and a shopping complex. The tower is close to 09-03 (51), but no fencing or even anti-climber was observed in the tower. It was also observed that the tower was easily accessible by the public as people were seen strolling underneath the tower. There was no deterrent to protect the public other than a Danger sign. BC Hydro is to explain to the NEB by 21 April 2017 how the 9-03(52) tower is deemed safe from unauthorized access.

BC Hydro informed the CER on August 8, 2019 that an anti-climbing barrier was installed.

4) xi. 10-01 (51 & 52): The tower for the Line 52 has a bent leg. BC Hydro is to inform to the NEB by 28 April 2017 when it will repair or replace the bent leg.

Action:

BC Hydro informed the CER on October 7, 2019 that BC Hydro's conclusion is that this defect is of minor severity, and so the CAV remains unchanged. At this time we are not going to apply a repair to this structure, however we do have the defect logged, and we will continue to review the defect when we inspect the structure in the future, and monitor for any change in condition.

4) xii. 10-03 (51): The structure was observed located inside a compound where ROW and the adjacent land is shared with the homeowner. The gate was closed with the homeowner lock and BC Hydro lock was not present. It was not sure how Hydro personnel can enter quickly during an emergency. The structure, conductor, and insulators are all fine.

BC Hydro stated on page 8 of its responses to the CER IRs (Attachment 2): "BC Hydro wants to advise the inspectors that the homeowner lock can and would be removed if we require emergency access. However, the situation will be brought to the attention of BC Hydro ROW Manager for review. BC Hydro will update the system accordingly and replace / acquire keys for any locks by March 31, 2018." As noted in its response, the homeowner lock can and would be removed if BC Hydro requires access therefore; keys for the locks were not replaced or acquired, and arrangements will be made when BC Hydro next needs to access the tower.

4) xiv. 13-04 (51): This is the last tower of the Line 51 before the border crossing and the conductor crosses over the 0 mile Avenue to the U.S. side. It was observed that the rain cap was missing in one of the corona ring. The missing cap was listed in the deficiency list, but no date was mentioned about when the deficiency was listed nor why it has not been addressed yet. BC Hydro is to inform the NEB by 21 April 2017 when it plans to repair the rain cap.

BC Hydro stated on page 9 of its responses to the CER IRs (Attachment 2): "BC Hydro wants to advise the inspectors that while the defect has been noted, this defect would not trigger an immediate replacement request. However we will look for opportunities to replace the rain cap by March 31, 2018." There have been no opportunities to date to replace the cap.

4) xv. 13-04 (52): This is the last tower before the border crossing. The structure was observed to be in good shape, but a little bit of rust stain on the porcelain strain insulator supporting the dead end of the conductor was observed. No point of immediate concern, but BC Hydro is to monitor the rust progress on the insulators.

BC Hydro stated on page 9 of its responses to the CER IRs (Attachment 2): "BC Hydro wants to advise the inspectors that the criteria for determining the

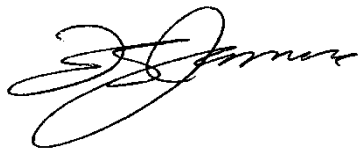
CAV for insulators is defined in Transmission Maintenance Standard 81.10-01-05 Maintenance of Porcelain and Toughened Glass Suspension Insulators.

Given the importance of the structure and the potential for rust staining to lead to a flashed string, BC Hydro will continue to monitor the site as part of our regularly scheduled inspections."

To conclude, BC Hydro has responded to the IRs from the CER and has addressed all of the deficiencies noted. In the Report of October 10, 2019 the CER closed all of the items and considers them to be resolved.

For further information, please contact Fred James at 604-623-4121 or by email at bchydroregulatorygroup@bchydro.com.

Yours sincerely,



Fred James
Chief Regulatory Officer

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Enclosure

BC Hydro
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International Power Lines 5L51 and 5L52 – Canada Energy Regulator (CER) Order for Electricity Reliability Standards – Compliance Verification Activity Report: CV1617-026

Attachment 1

CER Unredacted Version of the Final Inspection Report – October 10, 2019

From: donotreply@cer-rec.gc.ca
To: Robertson, Patricia
Subject: [External] CER"s Operation Regulatory Compliance Application - Inspection Report Closed - CV1617-026
Date: Thursday, October 10, 2019 2:21:30 PM

A final copy of the compliance verification report for CV1617-026 is included at the end of this message. If non-compliances were identified during the compliance activity, the officer considers them to be resolved. No further follow-up is required. If this activity is a Field Inspection or Emergency Exercise Evaluation, the CER may post the results of the activity on its external website.

Identified non-compliances to company plans or procedures are non-compliances either to:

- the condition of an authorization document that requires implementation of that plan or procedure; or
- to the relevant section of the regulations that requires implementation of that plan or procedure including those sections that require implementation of plans or procedures as part of a Program.

Event Type
Field Inspection

CV Event Number
CV1617-026

Name of the Regulated Company for this Event
British Columbia Hydro and Power Authority

Name of the Operating Company
British Columbia Hydro and Power Authority

Rationale, Scope, and Additional Description
There are two lines: 5L51 and 5L52. Both lines run parallel from Surrey, BC to Clustre, Washington for 21 km and they are both old lines from 1960s and 1970s; the instruments were issued in 1964 and in 1973 respectively. The lines are 21 km long and the inspection should verify how the ROW is maintained. The structural integrity of the lines are to be inspected along with the protective relays and battery banks in the control room of the substation where the lines originate.

Selected Province/Territory

- British Columbia

Landowner Complaint File Number
Not specified

Start Date
2017-03-14

End Date
2017-03-15

Inspection Officer Number

- 2615
- 2056T

Selected Disciplines

- Integrity Management

No Compliance Tool Used

This inspection was undertaken to verify compliance with the following legislative requirements:

- National Energy Board Act (NEBA)
    - National Energy Board General Order for Electricity Reliability Standards General Order MO-036-2012

Selected Regulatory Instrument Numbers
Not Selected

Additional Project-specific Requirements or Conditions
Not specified

Facility Details

- Facility Types
    - International Power Line (IPL)
        - • Conductors and shields
        - • Dampers and spacers
        - • Grounding
        - • Insulators
        - • Poles and towers
        - • Right of way
- Life-cycle Phases
    - • Operations

Additional Information

Selected Facilities
Not Selected

Observations (No follow-up required)

Common elements from the observations of the 5L51 and 5L52 lines

Date
2017-03-14

Discipline
Integrity Management

Categories

- Powerlines
  - Vegetation Control
  - Poles and Towers
  - Insulators
  - Conductors and Shields
  - Dampers & Spacers
  - Grounding

Facility

Latitude
49.15671300

Longitude
-122.87225831

Observations
General Comments:

- Overall conditions for most of the towers, insulators and conductors for both 51 & 52 are in good shape. No apparent sign of rusting, insulators are mostly in good shape, not many bent cross members were found, conductors and spacers were observed to be in good condition.
- In one instance, there was debris under the tower that needs to be cleared and was discussed with the company.
- In almost all of the towers that were inspected, the High Voltage Danger signage was missing. This is not generally consistent with the safety requirements of section 4.2.5 CSA Code C22.3 No. 15
- Some towers close to the residential areas were not fenced, had no anti-climbers and were easily accessible to the public. This is not generally consistent with the safety requirements of section 4.2.5 CSA Code C22.3 No. 15 and was discussed with the company.
- Most of the towers were installed without any concrete pads on their footings; the impact of this on structural support and grounding was discussed with the company.
- None of the towers, including the angle towers, have any guywires; the impact of this on structural stability was discussed with the company.
- The deficiency list that was produced by BC Hydro was not up-to-date and did not appear to be a living document. Deficiencies were recorded from 2001, but there were no updates as to whether they were fixed. Also, the rational of the CAV numbers and how the priorities of the deficiencies were selected was not well understood. **The NEB staff will follow it up further with BC Hydro.**

Compliance Tool Used
No Compliance Tool Used

The station batteries, metering and protection systems for 5L51 & 5L52 lines

Date
2017-03-14

Discipline
Integrity Management

Categories

- Powerlines
  - Poles and Towers
  - Conductors and Shields

Facility

Latitude
49.15671300

Longitude
-122.87225831

Observations

Control Room:

- Two sets of 129V DC battery banks were observed– Primary and Back up. The primary battery system is a flooded lead-acid KCR-11 type 129VDC battery bank from C&D Technologies and they were installed in 1992; the average life expectancy of the VRLA batteries appears to have been exceeded, and the replacement schedule was discussed with the company. **BC Hydro is to provide to the NEB a timeline by 21 April 2017 when the Primary battery bank will be replaced.**
- The electrolyte levels were found to be okay. They are visually inspected by BC Hydro staff quarterly. Each cell's voltages are tested annually. Information on load test was not provided. **BC Hydro is to privide to the NEB sample test results of the load test last performed on the primary and the back up battery banks by 28 April 2017 .**
- The back up battery bank is located in a separate room. The battery bank has a total of 58 batteries and the total voltage output is 129V DC. Similar to the primary battery bank, they were original installed in 1992. However, the old battery bank was replaced with a new set of battery bank with larger amp-hours from C&D Technologies.
- There are two revenue meters that measure the import and export of

the IPLs in MW, MVAR, MVA. The meters run in parallel thus each working as a back up to the other.
- Both lines use SEL-321 relays for primary and back up protections for the 5L51 and 5L52 lines.

Compliance Tool Used
No Compliance Tool Used

Inspection of the towers, insulators and conductors on 14 March 2017 for 5L51/52

Date
2017-03-14

Discipline
Integrity Management

Categories

- Powerlines
  - Vegetation Control
  - Poles and Towers
  - Insulators
  - Conductors and Shields
  - Dampers & Spacers
  - Grounding

Facility

Latitude
49.15686800

Longitude
-122.87372542

Observations
Towers:

- All are single circuit steel lattice towers carrying three phase conductors. Line to line voltage is 500 kV. Each phase has 4-conductor bundles separated by spacers.
- **00-01**: These are the first set of towers of both 51 and 52 outside the Ingledow substation. There was no sign of rusting, the conductor and insulators all are in good shape.
- **01-00:** The tower marking for 51 shows only the '00' numbers. The first disc of the glass insulator string shows chipped on the side. Needs to be fixed. **BCHydro will inform the NEB by 28 April 2017 when it plans to replace it.**
- **02-02 (51):** Angle structure, no guy wire, next to the pathway. The

condition of the tower, conductors, and the insulator strings is fine. Cathodic protection on the tower footing is buried under mounds of soil. Signage is there but no anti-climber. **BC Hydro will provide the rationale to the NEB by 28 April 2017 why no anti-climber or fence has not been installed for the tower that is so close to the pathway**. The tower marking was missing.
- **02-03 (51):** Angle tower. Cathodic protection, Danger sign – yes, no tower marking, conductors and insulators are fine.
- **02-04 (51):** Angle tower. Repair work on the base continues; the tower is standing next to a pathway; no anti-climber, no 'Danger-High Voltage' sign. The tower 2-04 for line 52 has the Danger sign but no tower marking.

Compliance Tool Used
No Compliance Tool Used

Inspection of the towers, insulators and conductors on 15 March 2017 for 5L51/52

Date
2017-03-15

Discipline
Integrity Management

Categories

- Powerlines
  - Vegetation Control
  - Poles and Towers
  - Insulators
  - Conductors and Shields
  - Dampers & Spacers
  - Grounding

Facility

Latitude
49.11703900

Longitude
-122.87593699

Observations

- **03-02 (51, 52):** towers are standing within a confined yard of a house. The owner used his key to for us to enter through the property. The tower, conductor and insulators are fine. It is an angle tower. However, plenty of debris were observed under the tower that

belongs to the 51 line. It's recorded in the BC Hydro deficiency list, and it was observed that the deficiency list suggested its removal in November 2014. **BC Hydro will inform the NEB by 21 April 2017 when it will remove the debris.**

- **03-03 (51):** Overhead clearance at the mid span between the span 3-02 (51) and 3-03(51) over the road was measured. The vertical clearance was measured to be approx. 68 ft. CSA 22-03 No. 15 requires vertical clearance over the travelled road 15.4 m for 500 kV line which translates to 50.52 ft. The clearance complies with the above CSA standard..
- **06-01 (51):** The tower, conductor, and insulators were observed to be in good condition. The The tower footings are submerged under the water in a low land. No danger sign or tower marking were observed.
- **06-02(51):** The tower, conductor, and insulators were observed to be in good condition and no corrosion was observed. The telecom equipment has been installed on top of the tower. Concrete footings for both 51 and 52 lines were observed to be in good shape.
- **06-05 (52):** The tower footings for both 51 and 52 lines have concrete pads. The concrete pads for the 52 line have cracked in few places. It is already marked in the deficiency list, but it is recorded for 51 line. BC Hydro is recommended to verify if the deficiency was marked correctly. **BC Hydro is to monitor the degradation of the base.**
- **7-04 (51):** Bent steel in all A, B, C, legs of the tower were recorded in the deficiency list. No evidence of bent steel was observed. The report was from 06/11/01. It might have been repaired already, but no record of the repair was captured in the list. **BC Hydro is to verify and confirm to the NEB by 21 April, 2017 when the concrete pads were repaired.**
- **8-03 (52):** The tower is fenced as there are communication equipment installed on top of the tower. Control instrumentations have been installed within the fenced perimeter of the tower. All elements of the transmission system were observed to be in good shape except one cross member which was found slightly bent. No signage was observed. **BC Hydro is to inform to the NEB by 21 April 2017 when it will repair the cross member.**
- **09-01 (51):** The tower is not fenced and it is readily accessible from the adjacent pathway in the nearby residential area. The tower 9-01 (52) has communication equipment installed on top of the tower and it is fenced. However, no anti-climber was observed for the 9-01 (51) line. **BC Hydro is to confirm to the NEB by 28 April 2017 that 9-01 (51) tower is safe from unauthorized access.** Danger sign was observed on the tower.
- **09-03 (51):** The tower is located on one side of the plaza and fenced barrier with barbed wire protects the tower and the control equipment installed for the communication.
- **09-03 (52):** The tower is located next to a residential area and a

shopping complex. The tower is close to 09-03 (51), but no fencing or even anti-climber was observed in the tower. It was also observed that the tower was easily accessible by the public as people were seen strolling underneath the tower. There was no deterrent to protect the public other than a Danger sign. **BC Hydro is to explain to the NEB by 21 April 2017 how the 9-03(52) tower is deemed safe from unauthorized access.**

- **10-01 (51 & 52):** The tower for the Line 52 has a bent leg. **BC Hydro is to inform to the NEB by 28 April 2017 when it will repair or replace the bent leg.**
- **10-03 (51):** The structure was observed located inside a compound where ROW and the adjacent land is shared with the homeowner. The gate was closed with the homeowner lock and BC Hydro lock was not present. It was not sure how Hydro personnel can enter quickly during an emergency. The structure, conductor, and insulators are all fine.
- **10-04 (52):** The structure again is inside the property where a horse ranch is present. Deficiency list suggested that a gate is needed. It was found that the gate is already there. Didn't have an opportunity to observe the tower closely as we didn't have the permission to enter the private property. However, from a distance it appeared the tower may not be accessible duw to the overgrown blackberry bushes. It was nit obvious how BC Hydro personnel can enter and/or access the tower during emergencies. **BC Hydro is to provide an explanation in this regard to the NEB by 21 April 2017**.
- **13-04 (51):** This is the last tower of the Line 51 before the border crossing and the conductor crosses over the 0 mile Avenue to the U.S. side. It was observed that the rain cap was missing in one of the corona ring. The missing cap was listed in the deficiency list, but no date was mentioned about when the deficiency was listed nor why it has not been addressed yet. **BC Hydro to is inform the NEB by 21 April 2017 when it plans to repair the rain cap.**
- **13-04 (52):** This is the last tower before the border crossing. The structure was observed to be in good shape, but a little bit of rust stain on the porcelain strain insulator supporting the dead end of the conductor was observed. No point of immediate concern, but **BC Hydro is to monitor the rust progress on the insulators.**

Compliance Tool Used
No Compliance Tool Used

Compliance Summary

link in this message does not work, copy the complete link text and paste it into the address line of your browser. Do not reply directly to this message as it comes from an account which is not monitored. If you encounter problems of any kind in using this system, please contact the CER at dlerssupport@cer-rec.gc.ca for assistance.

BC Hydro
Power smart

International Power Lines 5L51 and 5L52 – Canada Energy Regulator (CER) Order for Electricity Reliability Standards – Compliance Verification Activity Report: CV1617-026

Attachment 2

BC Hydro IR Responses in Relation to the CER's Draft Inspection Report - June 5, 2017

BC Hydro
Power smart

Patricia Robertson
Reliability Compliance Manager
BC Hydro Reliability Compliance
Phone: 604-528-2028
Email: patricia.robertson@bchydro.com

June 5, 2017

Tab Gangopadhyay
Integrity Management, Operations Business Unit
National Energy Board
517 10th Ave SW, Calgary AB, T2R 0A8
Email: Tab.Gangopadhyay@neb-one.gc.ca

Dear Tab,

RE: **NEB 5L51 5L52 Inspection March 14 & 15, 2017 Draft Inspection Report Information Requests**

Please see below the information / documentation requests from the draft inspection report as well as BC Hydro responses. Any referenced documents are enclosed in the PDF Portfolio.

Please note BC Hydro is providing these documents as requested and requests the NEB to treat them as confidential (ie not post them online or provide them to any third parties).

In general, BC Hydro commits to continuing with our inspection and repair, upgrade and replacement programs. We appreciate the feedback from the observation report and will track the items committed to and report back as appropriate.

NEB Draft Inspection Report Observations:

1) Common elements from the observations of the 5L51 and 5L52 lines – 2017-03-14
General Comments:

i. Overall conditions for most of the towers, insulators and conductors for both 51 & 52 are in good shape. No apparent sign of rusting, insulators are mostly in good shape, not many bent cross members were found, conductors and spacers were observed to be in good condition.
ii. In one instance, there was debris under the tower that needs to be cleared and was discussed with the company.
iii. In almost all of the towers that were inspected, the High Voltage Danger signage was missing. This is not generally consistent with the safety requirements of section 4.2.5 CSA Code C22.3 No. 15

BC Hydro Response: The inspector concern is noted and in general BC Hydro takes all steps to identify and adhere to the CSA requirements and has standards that also include details of selection and location prioritization criteria for barriers and signage. BC Hydro's

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anti-climbing barrier and signage requirements are outlined in the Transmission Maintenance Standard **82_10_03_00 Tower Signage and Anti-Climbing Barriers.**

BC Hydro would like to note that warning signage is not required at every transmission structure. As per CSA 22.3, section 4.2.5.1, the standards require "*Structures located on or adjacent to playgrounds or schoolyards and carrying open conductors of supply or communication lines shall be constructed, located, or guarded so as to prevent climbing by other than qualified persons*". Section 4.2.5.2 states that "*Structures that can be climbed without the use of special means and that carry supply line conductors that exceed 750V shall be protected by fences or other means against climbing, or shall carry signs in the predominant languages of the locality warning against trespass and calling attention to the hazards. Bridge fixtures supporting such conductors shall also be guarded and marked. Unguarded poles carrying conductors that exceed 750V shall not have permanent steps that are located less than 3m above the ground or surface and that give access to the pole*".

Typically BC Hydro Field Operations are directed to follow the criteria for action identified in section 3.0 of **82_10_03_00 Tower Signage and Anti-Climbing Barriers**. For sites scoped for signage and / or barriers, the details are entered in our maintenance tracking system STARR (System for Transmission Asset Recording & Reporting) and immediate action taken. BC Hydro manages a large system and we appreciate the feedback on the observed sites. We have instructed Field Operations to carry out a review based on our standards which is already underway and once this is complete we commit to taking appropriate action. We will ensure the review is completed by the second quarter of this fiscal year and make sure all required work is executed by March 31, 2018.

iv. Some towers close to the residential areas were not fenced, had no anti-climbers and were easily accessible to the public. This is not generally consistent with the safety requirements of section 4.2.5 CSA Code C22.3 No. 15 and was discussed with the company.

BC Hydro Response: The inspector concern is noted and the feedback appreciated. Per BC Hydro's response to Observation 1 (iii), BC Hydro will ensure the review based on our standards is completed by the second quarter of this fiscal year and make sure all required work is executed by March 31, 2018.

v. Most of the towers were installed without any concrete pads on their footings; the impact of this on structural support and grounding was discussed with the company.

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that the absence of concrete is not a deficiency or cause for concern in any way. The large majority of BC Hydro's structures were designed without concrete footings. The design of structures and their foundations is a complex exercise carried out by registered professional civil engineers, geotechnical engineers, electrical engineers and transmission line designers. The majority of steel structures on BC Hydro's transmission system have direct buried steel foundations which rely on the mass of earth above and around them to keep the structure stable. These foundations have provided decades of service for BC Hydro and many major utilities around the world and BC Hydro continues to design and install them. In some cases due to the high structural and mechanical loads expected for a

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structure, or in cases where the soil condition is inadequate to support the structure; then, a reinforced concrete foundation may be designed and installed.

vi. None of the towers, including the angle towers, have any guywires; the impact of this on structural stability was discussed with the company.

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that the absence of guy wires is not a deficiency or cause for concern in any way. For the observed structures on 5L51 and 5L52, guy wires are not required since they are self-supporting (rigid) structures. Although the large majority of BC Hydro's steel structures are designed with guy wires this is because those structures are intentionally designed as "guyed" structures. They are usually lighter, less expensive and easer to construct, have smaller foundations and so find some utility in steel structural design. In some cases however a "rigid" structure is required – generally for reduced footprint or to accommodate very high loads or large line angles etc. Likewise, as mentioned for the foundation concrete issue raised in Observation 1 (v), the design of structures and their foundations is a complex exercise carried out by registered professional civil engineers, geotechnical engineers, electrical engineers and transmission line designers. A guyed structure relies on the guy wires for stability and resistance to overturning while a rigid structure relies on the structure rigidity and foundation capacity.

vii. The deficiency list that was produced by BC Hydro was not up-to-date and did not appear to be a living document. Deficiencies were recorded from 2001, but there were no updates as to whether they were fixed. Also, the rational of the CAV numbers and how the priorities of the deficiencies were selected was not well understood. **The NEB staff will follow it up further with BC Hydro.**
[NEB Email: How does BC Hydro's CAV system determine the priority? NEB were told that 'A' is the lowest priority whereas 'E' is the highest. In many cases, the list suggests that 'sign missing' as 'E', but corrosion of the same tower footing or the cross-member as 'B'. How can the corrosion can have a lower priority than a sign missing?]

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that the criteria and qualifications for performing inspections are enshrined in BC Hydro standards. With respect to the issues raised please be advised as follows:

All of our defect data is up to date as per the schedule for inspections prescribed in our maintenance standards and details are entered in our maintenance tracking system STARR. Unfortunately during the inspection, an updated list was not provided to the inspectors. In general, we carry out inspections on an exception basis and the date a defect was noted does not pre-suppose when it should be repaired. That decision is based on defect severity, importance, consequence, resource availability and expediency for completing the work.

o Understanding CAV

A Condition Assessment Value (CAV) is given in order to rate the relative condition of an asset or component. It is a sliding scale that ranges from CAV "A" (good as new) to CAV "E" (end of life or missing or failed in service) as defined in our Transmission Maintenance Standard **80_30_01_02 Detailed Inspection - Overhead** shown below:

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Condition Assessment Value - CAV				
New /Good	Damage / Wear / Decay			Failed /Broken
A	B	C	D	E
Component is in "Like new condition"	Low	Moderate	High	Component has either broken or failed completely

o Understanding work prioritization

CAV's are just one input into work prioritization. They are largely our inspectors' assessment (based on standards) of the in-service condition of an asset or component. Priority rankings for work approval are based on CAV, safety implications, available budget, constructability, impact of negative outcomes from defect, and upcoming (potential) complementary projects. The task or prioritizing work is handled by BC Hydro Asset Managers with input and collaboration with others across the company.

With respect to the specific question "*How can the corrosion can have a lower priority than a sign missing?*" The simple answer is - It cannot. However from the data it is possible that a footing could be in condition CAV "B" and a missing number sign in CAV "E". All that means is that relative to other footings the observed one is in a low state of damage or wear with CAV "B" and relative to towers with signs the one with a missing sign would be a CAV "E". This is not in any way reflective of relative importance against each other and is generally not misconstrued as such by our engineers, trained line inspectors, contractors and technicians. In fact we have stopped the practice of considering missing wood pole caps and missing number signs as defects.

2) The station batteries, metering and protection systems for 5L51 & 5L52 lines – 2014-03-14
Control Room:

i. Two sets of 129V DC battery banks were observed– Primary and Back up. The primary battery system is a flooded lead-acid KCR-11 type 129VDC battery bank from C&D Technologies and they were installed in 1992; the average life expectancy of the VRLA batteries appears to have been exceeded, and the replacement schedule was discussed with the company. **BC Hydro is to provide to the NEB a timeline by 21 April 2017 when the Primary battery bank will be replaced.**

BC Hydro Response: BC Hydro replaces flooded lead-acid batteries based on condition or at 25 years. The battery bank is being replaced in fiscal 2017 as it has reached 25 years of life.

ii. The electrolyte levels were found to be okay. They are visually inspected by BC Hydro staff quarterly. Each cell's voltages are tested annually. Information on load test was not provided. **BC Hydro is to provide to the NEB sample test results of the load test last performed on the primary and the backup battery banks by 28 April 2017.**

BC Hydro Response: The Discharge Capacity Test (load test) for flooded lead-acid batteries is performed at 18 years. In this case, the 2011 discharge capacity test data for Ingledow

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primary battery bank cannot be located. The discharge capacity test from November 2000 for the Ingledow secondary battery bank is **ING Batt#2 Discharge Capacity Test Record**. Subsequent to this inspection, a verification process has been implemented to ensure test data is recorded consistently in a central location.

iii. The backup battery bank is located in a separate room. The battery bank has a total of 58 batteries and the total voltage output is 129V DC. Similar to the primary battery bank, they were original installed in 1992. However, the old battery bank was replaced with a new set of battery bank with larger amp-hours from C&D Technologies.

iv. There are two revenue meters that measure the import and export of the IPLs in MW, MVAR, MVA. The meters run in parallel thus each working as a back up to the other.

v. Both lines use SEL-321 relays for primary and back up protections for the 5L51 and 5L52 lines.

3) Inspection of the towers, insulators and conductors on 14 March 2017 for 5L51/52 – 2014-03-14

Towers:

i. All are single circuit steel lattice towers carrying three phase conductors. Line to line voltage is 500 kV. Each phase has 4-conductor bundles separated by spacers.

ii. **00-01**: These are the first set of towers of both 51 and 52 outside the Ingledow substation. There was no sign of rusting, the conductor and insulators all are in good shape.

iii. **01-00:** The tower marking for 51 shows only the '00' numbers. The first disc of the glass insulator string shows chipped on the side. Needs to be fixed. **BCHydro will inform the NEB by 28 April 2017 when it plans to replace it.**

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that the criteria for determining the CAV for insulators is defined in Transmission Maintenance Standard **81_10_01_05 Maintenance of Porcelain and Toughened Glass Suspension Insulators.** According to BC Hydro standards, the subject insulator string would be classified as CAV "B". If there were up to 4 bells cracked / damaged or flashed then the CAV for a typical 500kV structure would be CAV 'C" and so on. As such no action is immediately needed on this string and our Field Operations staff are aware of this.

iv. **02-02 (51):** Angle structure, no guy wire, next to the pathway. The condition of the tower, conductors, and the insulator strings is fine. Cathodic protection on the tower footing is buried under mounds of soil. Signage is there but no anti-climber. **BC Hydro will provide the rationale to the NEB by 28 April 2017 why no anti-climber or fence has not been installed for the tower that is so close to the pathway**. The tower marking was missing.

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that a review of this structure will be done as part of the marker and barrier review exercise ongoing. This exercise and timelines for completion of the study and any work required will be as per our response to Observation 1 (iii).

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v. **02-03 (51):** Angle tower. Cathodic protection, Danger sign – yes, no tower marking, conductors and insulators are fine.
vi. **02-04 (51):** Angle tower. Repair work on the base continues; the tower is standing next to a pathway; no anti-climber, no 'Danger- High Voltage' sign. The tower 2-04 for line 52 has the Danger sign but no tower marking.

4) Inspection of the towers, insulators and conductors on 15 March 2017 for 5L51/52 – 2016-03-15

Observations

i. **03-02 (51, 52):** towers are standing within a confined yard of a house. The owner used his key to for us to enter through the property. The tower, conductor and insulators are fine. It is an angle tower. However, plenty of debris were observed under the tower that belongs to the 51 line. It's recorded in the BC Hydro deficiency list, and it was observed that the deficiency list suggested its removal in November 2014. **BC Hydro will inform the NEB by 21 April 2017 when it will remove the debris.**

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that a review of this structure has been done and contractors and equipment will be coordinated so that the debris will be removed by June 2017.

ii. **03-03 (51):** Overhead clearance at the mid span between the span 3-02 (51) and 3-03(51) over the road was measured. The vertical clearance was measured to be approx. 68 ft. CSA 22-03 No. 15 requires vertical clearance over the travelled road 15.4 m for 500 kV line which translates to 50.52 ft. The clearance complies with the above CSA standard.
iii. **06-01 (51):** The tower, conductor, and insulators were observed to be in good condition. The tower footings are submerged under the water in a low land. No danger sign or tower marking were observed.
iv. **06-02(51):** The tower, conductor, and insulators were observed to be in good condition and no corrosion was observed. The telecom equipment has been installed on top of the tower. Concrete footings for both 51 and 52 lines were observed to be in good shape.
v. **06-05 (52):** The tower footings for both 51 and 52 lines have concrete pads. The concrete pads for the 52 line have cracked in few places. It is already marked in the deficiency list, but it is recorded for 51 line. BC Hydro is recommended to verify if the deficiency was marked correctly. **BC Hydro is to monitor the degradation of the base.**

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that the CAV "B" assigned to this structure foundation is based on Transmission Maintenance Standard **82_40_01_00 Requirements for Civil & Geotechnical Hazard Inspections**. Based on the assigned CAV, BC Hydro will not carry out any special monitoring or inspections as the condition is that of normal wear over the years. As part of our civil hazard inspections carried out by competent geotechnical and foundation engineers, we will continue to review this site as a normal instance for all sites with concrete or other foundation types.

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vi. **7-04 (51):** Bent steel in all A, B, C, legs of the tower were recorded in the deficiency list. No evidence of bent steel was observed. The report was from 06/11/01. It might have been repaired already, but no record of the repair was captured in the list. **BC Hydro is to verify and confirm to the NEB by 21 April, 2017 when the concrete pads were repaired.**

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that the CAV "C" assigned to this structure steel would typically be based on BC Hydro standards and engineering design practice. While the defect has been noted by the inspector and corresponds to records in our maintenance tracking system STARR, our expectation is that it would have likely been repaired at the earliest opportunity. In principle, BC Hydro wants to point out that unless this defect was ranked as a CAV "D" or CAV "E", it would not have triggered an immediate repair or replacement request. However we are confident that if no damage was observed on site then the defect has indeed been repaired. Based on STARR records available, the defect was recorded in November 2001, assigned a low priority with instruction to monitor and subsequently shows as modified in November 2011. The data doesn't specifically say the defect was fixed / repaired, but anecdotally from the observers we note that if there was no evidence in the field of the defect then any work was likely completed. To verify the work completion, BC Hydro will review the structure and update any missed records or otherwise delete all erroneous defects from STARR by March 31, 2018.

vii. **8-03 (52):** The tower is fenced as there are communication equipment installed on top of the tower. Control instrumentations have been installed within the fenced perimeter of the tower. All elements of the transmission system were observed to be in good shape except one cross member which was found slightly bent. No signage was observed. **BC Hydro is to inform to the NEB by 21 April 2017 when it will repair the cross member.**

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that the CAV "C" assigned to this structure steel is based on BC Hydro standards and engineering design practice. While the defect has been noted, similar to our response to Observation 4 (vi), this defect would not trigger an immediate repair or replacement request. However we will continue to monitor and may replace upon opportunity.

viii. **09-01 (51):** The tower is not fenced and it is readily accessible from the adjacent pathway in the nearby residential area. The tower 9-01 (52) has communication equipment installed on top of the tower and it is fenced. However, no anti-climber was observed for the 9-01 (51) line. **BC Hydro is to confirm to the NEB by 28 April 2017 that 9-01 (51) tower is safe from unauthorized access.** Danger sign was observed on the tower.

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that a review of this structure will be done as part of the marker and barrier review exercise ongoing. This exercise and timelines for completion of the study and any work required will be as per our response to Observation 1 (iii). As a point of note, all towers have the means of climbing (step bolts) removed up to 3m above ground at the time of installation. This together with the danger signage posted is intended as a deterrent. We will evaluate the requirement to proceed with more active prevention methods as part of the

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ongoing marker and barrier review exercise. NEB will be advised as appropriate upon completion of any work.

ix. **09-03 (51):** The tower is located on one side of the plaza and fenced barrier with barbed wire protects the tower and the control equipment installed for the communication.

x. **09-03 (52):** The tower is located next to a residential area and a shopping complex. The tower is close to 09-03 (51), but no fencing or even anti-climber was observed in the tower. It was also observed that the tower was easily accessible by the public as people were seen strolling underneath the tower. There was no deterrent to protect the public other than a Danger sign. **BC Hydro is to explain to the NEB by 21 April 2017 how the 9-03(52) tower is deemed safe from unauthorized access.**

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that a review of this structure will be done as part of the marker and barrier review exercise ongoing. This exercise and timelines for completion of the study and any work required will be as per our response to Observation 1 (iii). As a point of note, all towers have the means of climbing (step bolts) removed up to 3m above ground at the time of installation. This together with the danger signage posted is intended as a deterrent. We will evaluate the requirement to proceed with more active prevention methods as part of the ongoing marker and barrier review exercise. NEB will be advised as appropriate upon completion of any work.

xi. **10-01 (51 & 52):** The tower for the Line 52 has a bent leg. **BC Hydro is to inform to the NEB by 28 April 2017 when it will repair or replace the bent leg.**

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that the CAV "C" assigned to this structure steel is based on BC Hydro standards and engineering design practice. While the defect has been noted, similar to our response to Observation 4 (vi), this defect would not trigger an immediate repair or replacement request. Given that it's a leg member and therefore important we will continue to monitor and also commission a review and possible replacement by March 31, 2018.

xii. **10-03 (51):** The structure was observed located inside a compound where ROW and the adjacent land is shared with the homeowner. The gate was closed with the homeowner lock and BC Hydro lock was not present. It was not sure how Hydro personnel can enter quickly during an emergency. The structure, conductor, and insulators are all fine.

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that the homeowner lock can and would be removed if we require emergency access. However, the situation will be brought to the attention of BC Hydro ROW Manager for review. BC Hydro will update the system accordingly and replace / acquire keys for any locks by March 31, 2018.

xiii. **10-04 (52):** The structure again is inside the property where a horse ranch is present. Deficiency list suggested that a gate is needed. It was found that the gate is already there. Didn't have an opportunity to observe the tower closely as we didn't have the permission to enter the private property. However, from a distance it appeared the tower may not be accessible duw to the overgrown blackberry bushes. It was nit obvious how BC Hydro

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personnel can enter and/or access the tower during emergencies. **BC Hydro is to provide an explanation in this regard to the NEB by 21 April 2017**.

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that we have extensive experience managing access with the presence of vegetation around our sites. For regular projects we typically brush out the site but for emergencies we could do the same or else access the tower used boards placed over the bushes. BC Hydro does not consider this a major issue with any effect on our emergency response capability.

xiv. **13-04 (51):** This is the last tower of the Line 51 before the border crossing and the conductor crosses over the 0 mile Avenue to the U.S. side. It was observed that the rain cap was missing in one of the corona ring. The missing cap was listed in the deficiency list, but no date was mentioned about when the deficiency was listed nor why it has not been addressed yet. **BC Hydro to is inform the NEB by 21 April 2017 when it plans to repair the rain cap.**

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that while the defect has been noted, this defect would not trigger an immediate replacement request. However we will look for opportunities to replace the rain cap by March 31, 2018.

xv. **13-04 (52):** This is the last tower before the border crossing. The structure was observed to be in good shape, but a little bit of rust stain on the porcelain strain insulator supporting the dead end of the conductor was observed. No point of immediate concern, but **BC Hydro is to monitor the rust progress on the insulators.**

BC Hydro Response: The inspector concern is noted. BC Hydro wants to advise the inspectors that the criteria for determining the CAV for insulators is defined in Transmission Maintenance Standard **81_10_01_05 Maintenance of Porcelain and Toughened Glass Suspension Insulators.**

Given the importance of the structure and the potential for rust staining to lead to a flashed string, BC Hydro will continue to monitor the site as part of our regularly scheduled inspections.