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Utilities Commission

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ORDER NUMBER
R-9-23

IN THE MATTER OF
the *Utilities Commission Act*, RSBC 1996, Chapter 473

and

British Columbia Hydro and Power Authority
Confidentiality of Confirmed Violations of the
FAC-003 Transmission Vegetation Management Mandatory Reliability Standard

BEFORE:
B. A. Magnan, Commissioner

on March 31, 2023

ORDER

WHEREAS:

A. On March 22, 2022, the British Columbia Utilities Commission (BCUC) issued confidential Order R-10-22 confirming the following eight violations of the FAC-003 Transmission Vegetation Management Reliability Standard by the British Columbia Hydro and Power Authority (BC Hydro) (Confirmed Violations) and directed all compliance materials related to the violations be held confidential until the BCUC determines otherwise;

BCUC Violation ID	Reliability Standard and Requirement
BCUC2019000681	FAC-003-4 R2
BCUC2020000724	FAC-003-4 R2
BCUC2020000725	FAC-003-4 R2
BCUC2020000726	FAC-003-4 R2
BCUC2020000733	FAC-003-4 R2
BCUC2020000734	FAC-003-4 R2
BCUC2020000735	FAC-003-4 R2
BCUC2020000728	FAC-003-3 R6

B. By Order G-123-09, dated October 15, 2009, the BCUC approved the Rules of Procedure for Reliability Standards in British Columbia (BC ROP), including the Compliance Monitoring Program (CMP) appended thereto, which provides processes for monitoring compliance with reliability standards adopted by the BCUC. Most recent revisions to the CMP were approved by Order R-40-17, dated September 1, 2017;

C. Order G-123-09 also appointed the Western Electricity Coordinating Council (WECC) as the BCUC's Administrator for monitoring compliance for the British Columbia Mandatory Reliability Standards Program, as per section 8 of the UCA and in adherence with the BC ROP and CMP. The Administration Agreement between WECC and the BCUC was signed on October 8, 2009, and WECC's role as Administrator for the BC MRS Program was renewed most recently on July 5, 2019;

D. On June 19, 2020, WECC issued confidential and public versions of a compliance violation investigation report regarding a Compliance Violation Investigation of BC Hydro pertaining to FAC-003-4 which was initiated by various vegetation caused sustained outages in 2019 and warranted by BCUC Order R-18-19, dated September 9, 2019 (CVI Report);

E. On April 8, 2022, WECC issued a revision of Notice of Alleged Violation (NOAV) CF1867 to BC Hydro citing alleged violations of the FAC-003 Transmission Vegetation Management Mandatory Reliability Standard (NOAV CF1867);

F. On October 17, 2022, BC Hydro filed its submissions on confidentiality. BC Hydro stated should the BCUC determine it must decide on the treatment of NOAV CF1867 and the CVI Report prior to the conclusion of the associated penalty proceeding, it submitted that NOAV CF1867 and the CVI Report should not be released;

G. By Order R-36-22 dated November 9, 2022, the BCUC established a further regulatory timetable allowing BC Hydro the opportunity to file proposed redactions to versions of NOAV CF1867 and the CVI Report;

H. On November 23, 2022, BC Hydro stated that if the BCUC decides that the release of NOAV CF1867 and the CVI Report prior to the conclusion of the associated penalty proceeding, that NOAV CF1867 and the public version of the CVI Report with redactions be released;

I. By Order R-39-22 dated December 12, 2022, the BCUC adjourned this proceeding pending the conclusion of the associated penalty proceeding;

J. By Order R-3-23 dated January 30, 2023, the BCUC concluded the associated penalty proceeding by publicly releasing the confirmation order and the Notice of Penalty with Reasons for Decision for the Confirmed Violations; and

K. The BCUC has reviewed BC Hydro's submissions and determines that the public release of NOAV CF1867 and a redacted CVI Report is warranted.

NOW THEREFORE the BCUC orders as follows:

1. The redacted CVI Report dated June 19, 2022 is to be made public, as attached in Appendix A.

2. NOAV CF1867 dated April 8, 2022 is to be made public, as attached in Appendix B.

DATED at the City of Vancouver, in the Province of British Columbia, this 31st day of March 2023.

BY ORDER

Original signed by:

B. A. Magnan
Commissioner

Attachment

WECC ID:	WCR0003		
Registered Entity Name:	British Columbia Hydro and Power Authority		
Registered Entity Acronym:	BCHA		
BC Reliability Standards Scope:	FAC-003-4		
Compliance Monitoring Process:	Compliance Violation Investigation (CVI)		
Distribution:	Public		
Regional Entity:	Western Electricity Coordinating Council (WECC)		
Date of Opening Presentation:	December 3, 2019	Date of Closing Presentation:	March 26, 2020
Date of Report:	June 19, 2020		
Jurisdiction:	British Columbia Utilities Commission (BCUC)		

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Executive Summary

WECC conducted a Compliance Violation Investigation (CVI) of British Columbia Hydro and Power Authority (BCHA), WECC ID WCR0003 from September 11, 2019 to March 26, 2020.

British Columbia (BC) Reliability Standard FAC-003-4 is applicable to Transmission Owners and Generation Owners.

On May 24, 2019, WECC received a FAC-003-4 - Vegetation-Caused Sustained Outage 48-Hour Reporting form from BCHA. In the report, BCHA explained it experienced a Category 1B — Grow-in outage ("Sustained Outages caused by vegetation growing into applicable lines but are not identified as an element of an IROL or Major WECC Transfer Path, by vegetation inside and/or outside of the ROW") on the 2L09 230kV transmission line. The outage occurred on May 22, 2019 at 19:43.

On July 19, 2019 WECC received a Second Quarter 2019 FAC-003-4 – Vegetation-Caused Sustained Outage Quarterly Report. In the report, BCHA explained it experienced a Category 1B — Grow-in outage on the 2L09 230kV transmission line. The outage occurred on June 4, 2019 at 20:51.

On August 21, 2019, WECC received a Self-Reported Violation (SRV) of BC Reliability Standard FAC-003-4 R2 from BCHA. In the Detailed Description and Cause of Possible Violation section of the SRV, BCHA explained:

> "Between May 22, 2019 and June 7, 2019 BC Hydro has had four instances of vegetation encroachment on the 2L09 and 2L17 230kV circuits located in the West and North Vancouver area. Three involved circuit 2L09 located in the Capilano Watershed, two of which resulted in a forced outage. The fourth encroachment occurred on circuit 2L17 which did not result in a circuit outage, however, a tree was found with a burnt top. For the two instances with outages, a Control Room Operations Window (CROW) entry was made. Following the initial outage on May 22nd, BC Hydro conducted a series of helicopter patrols of the Bulk Electric System (BES) in the Lower Mainland followed up by detailed ground patrols. Vegetation contractors have been deployed to clear vegetation in areas requiring maintenance. No further instances of vegetation encroachments within the Minimum Vegetation Clearance Distance (MVCD) as per FAC-003-4 have been observed since June 7, 2019."

On September 11, 2019, WECC determined a CVI of BCHA's compliance with all Requirements of BC Reliability Standard FAC-003-4 was warranted based on four (4) encroachments of vegetation into the Minimum Vegetation Clearance Distance (MVCD) on two (2) of its applicable transmission lines. The

vegetation encroachments resulted in two (2) sustained vegetation-related outages. WECC formally notified BCHA of the CVI by uploading a Notice of Compliance Violation Investigation via the WECC EFT Server.

BCHA submitted evidence for the Compliance Violation Investigation Team's (CVI Team) evaluation of compliance with the requirements identified in the CVI Notice. The CVI Team reviewed and evaluated the evidence provided to assess compliance with the seven (7) requirements of BC Reliability Standard, FAC-003-4.

Between December 2 – 6, 2019 the CVI Team travelled to Vancouver, BC and conducted on-site interviews with BCHA senior leaders, managers, subject matter experts (SMEs), and compliance staff.

BCHA cooperated fully during the CVI and ensured its senior leadership, managers, SMEs, and compliance staff were available and responsive to multiple data requests, interview requests, and an onsite visit request from the CVI Team.

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The CVI Team notified BCHA of no areas of concern and no recommendations. Possible Violations (PV) will be processed as outlined in the British Columbia Utilities Commission (BCUC) Compliance Monitoring Program (CMP), Appendix 2 to the BCUC Rules of Procedure (ROP).

BCHA provided a draft copy of its Mitigation Plan (MP), dated February 2, 2020, to WECC. The CVI Team reviewed the draft MP and returned it to BCHA with comments. BCHA submitted a final version of its MP to WECC which was dated, March 3, 2020. The final version of the MP will be processed by WECC's Risk & Mitigation Team.

The CVI Team lead certifies that the CVI Team adhered to all applicable requirements of the BCUC ROP and CMP.

Compliance Violation Investigation Process

The CVI process steps are detailed in the BCUC CMP. The CMP generally conforms to the United States Government Auditing Standards and other generally accepted audit practices.

Objectives

Under section 2.4 of the CMP, a Compliance Violation Investigation may be initiated at any time by the BCUC or, with the approval of the BCUC, the Administrator in response to a system disturbance, Complaint, or any Possible Violation with a Reliability Standard identified by any other means. In this case, the CVI was initiated by four (4) encroachments of vegetation into the Minimum Vegetation Clearance Distance (MVCD) on two (2) of the entity's applicable transmission lines. The vegetation encroachments resulted in two (2) sustained vegetation-related outages.

All registered entities are subject to compliance assessments with all BC Reliability Standards applicable to the functions for which they are registered. The CVI objectives in this case are:

- Provide reasonable assurance of compliance with the applicable Reliability Standards identified in the Notice of Compliance Investigation from WECC to BCHA dated, September 11, 2019; and
- Review evidence for a self-reported violation.

Scope

The Compliance Investigation was initiated to evaluate the registered entity's compliance with BC Reliability Standards because of four (4) encroachments of vegetation into the MVCD of two (2) of its applicable transmission lines that resulted in two (2) sustained vegetation-related outages;

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The CVI Team did not expand the scope of the CVI beyond what was stated in the notification package.

Controls

The CVI Team reviewed BCHA's internal controls associated with some of the BC Reliability Standard Requirements in scope for this CVI. The review was limited to requirements where there was an Open Action or where the CVI Team identified a PV.

In an effective compliance program, a registered entity's internal control components work together to provide reasonable assurance the organization will maintain compliance with mandatory BC Reliability Standards. BCHA's internal controls for its Transmission Vegetation Management Program (TVMP) imply a risk-based assessment like what is documented in part A. Section 6 of the Introduction of BC Reliability Standard FAC-003-4 (see Page 2 of 31 – "6. Background:").

6. **Background:** This standard uses three (3) types of requirements to provide layers of protection to prevent vegetation-related outages that could lead to Cascading:
   a) Performance-based defines a particular reliability objective or outcome to be achieved. In its simplest form, a results-based requirement has four components: *who, under what conditions (if any), shall perform what action, to achieve what particular bulk power system performance result or outcome?*
   b) Risk-based preventive requirements to reduce the risks of failure to acceptable tolerance levels. A risk-based reliability requirement should be framed as: *who, under what conditions (if any), shall perform what action, to achieve what particular result or outcome that reduces a stated risk to the reliability of the bulk power system?*
   c) Competency-based defines a minimum set of capabilities an entity needs to have to demonstrate it is able to perform its designated reliability functions. A competency-based reliability requirement should be framed as: *who, under what conditions (if any), shall have*

what capability, to achieve what particular result or outcome to perform an action to achieve a result or outcome or to reduce a risk to the reliability of the bulk power system?

BCHA has identified, implemented, and is monitoring several detective, preventative, and mitigation-based controls. BCHA is currently designing and implementing additional performance-based and competency-based controls. The CVI Team observed, during the period of the CVI, BCHA was still in the process of evaluating how it would test its suite of TVMP controls.

The CVI Team is aware BCHA undertook a Root Cause Analysis (RCA) processes following the four (4) vegetation encroachments into two (2) of its applicable transmission lines. BCHA leadership stated that identifying, implementing, monitoring, and testing internal controls for its TVMP continues to be a priority.

The CVI Team identified some deficiencies in internal control design and implementation for some Requirements as they were at the time of the CVI. The deficiencies are documented in the Compliance Violation Investigation Findings section later in this report.

Confidentiality and Conflict of Interest

Confidentiality and conflict of interest of the CVI Team are governed under BCUC ROP. BCHA was informed of WECC's obligations and responsibilities under the BCUC ROP and CMP. The work history for each CVI Team member was provided to BCHA, which was given an opportunity to object to a CVI Team member's participation on the basis of a possible conflict of interest or the existence of other circumstances that could interfere with a CVI Team member's impartial performance of duties. BCHA had not submitted any objections by the stated objection due date based on the ROP and accepted the CVI Team member participants without objection. There were no denials or access limitations placed upon this CVI Team by BCHA.

Methodology

WECC provided BCHA with a CVI notification package to commence the CVI. BCHA provided evidence at the time requested, or as agreed upon, by WECC. The CVI Team reviewed the evidence submitted by BCHA and assessed compliance with the requirements of the applicable BC Reliability Standards. Additional evidence could be submitted until the agreed-upon deadline prior to the exit briefing. After that date, only data or information that was relevant to the content of the report or its finding could be submitted with the agreement of the CVI Team lead.

The CVI Team reviewed documentation provided by BCHA and requested additional evidence and sought clarification from SME's during the CVI. The evidence submitted in the form of policies, procedures, emails, logs, studies, data sheets, etc., were validated, substantiated, and cross-checked for

accuracy as appropriate. Where sampling was applicable to a requirement, the sample set was determined by a statistical methodology, along with professional judgment.

The findings were based on the facts and documentation reviewed, interviews, the CVI Team's knowledge of the Bulk Electric System (BES), the BC Reliability Standards, and professional judgment. All findings were developed based upon the consensus of the CVI Team.

Company Profile

BCHA is a British Columbia provincial Crown corporation, and one of the largest electric utilities in Canada. The company's mandate is to generate, purchase, transmit, distribute, and sell electricity.

BCHA distributes electricity produced by several hydroelectric, thermal, and other generation facilities to the majority of B.C.'s population. BCHA also purchases power from Independent Power Producers (IPPs) or from the open market.

Hydroelectric plants consist of a dam, a reservoir, a powerhouse, and a switchyard. At each hydroelectric plant, water from a reservoir flows into the powerhouse. The flowing water turns turbines (rotating blades), which in turn drive generators. Thermal plants operate similarly, except the energy used to turn the turbines is produced by natural gas, diesel, or biofuels. Generators convert the turbine's mechanical energy into electrical energy. Transformers located within switching stations convert the generators' low-voltage electricity to a higher voltage, between 60,000–500,000 volts, to move power over long distances via transmission lines to substations. BCHA has over 18,286 kilometres (km) of transmission lines within power line corridors that cover approximately 75,000 hectares (ha) of right-of-way (ROW). Most transmission corridors run cross-country in rural or undeveloped areas on statutory rights-of-way, but many lower voltage 69kV circuits are along road allowances. The legal widths of transmission rights-of-way vary from 10 metres (m) to about 300 m. Individual transmission lines vary in length from 1 km to 500 km.

BCHA has two (2) 500kV lines and two (2) 230kV line interconnected with Bonneville Power Authority (BPA) in the USA. (WECC Path 3).

BCHA has one (1) 500kV line and two (2) 138kV lines connected to the Alberta Electric System Operator (AESO) in Alberta, Canada. (WECC Path 1).

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Compliance Violation Investigation Findings

The information in Table 3: Findings and Supporting Evidence details the assessment results for the BC Reliability Standards and Requirements identified in the scope of this CVI.

Table 3: Findings and Supporting Evidence

BC Reliability Standard	Requirement	Registered Functions	Category of Finding
FAC-003-4	R1	GO, TO	No Finding

Description of Finding

BCHA managed vegetation to prevent encroachments into the Minimum Vegetation Clearance Distance (MVCD) of its applicable line(s) which are either an element of an IROL, or an element of a Major WECC Transfer Path; operating within their Rating and all Rated Electrical Operating Conditions of the four (4) types described in 1.1 -1.4 of Requirement R1.

Primary Documents Supporting Finding:

[redacted]

BC Reliability Standard	Requirement	Registered Function	Category of Finding
FAC-003-4	R2	GO, TO	Possible Violation WECC Violation ID: BCUC2019000681

Description of Finding

Summary Findings Statement

Between May 22, 2019 and June 7, 2019 BCHA failed to manage vegetation to prevent three (3) encroachments due to vegetation growth into the MVCD of the 2L09 230kV transmission line and one encroachment due to vegetation growth into the MVCD of the 2L17 230kV transmission line. Each vegetation encroachment into the MVCD is a distinct PV of Requirement R2.

The first vegetation encroachment occurred on May 22, 2019 at 19:43 PDT on transmission line 2L09 mid-span between structures 52/2 and 52/3. The encroachment caused a 10-minute vegetation-related Sustained Outage on a transmission line that is not either an element of an IROL, or an element of a Major WECC Transfer Path; operating within its Rating and all Rated Electrical Operating

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Table 3: Findings and Supporting Evidence
Conditions in accordance with sub-requirement, type 2.4[i]. The second vegetation encroachment occurred on June 4, 2019 at approximately 17:00 PDT on transmission line 2L17 near mid-span between structures 676 and 677. The transmission line is not either an element of an IROL, or an element of a Major WECC Transfer Path and was operating within its Rating and all Rated Electrical Operating Conditions in accordance with sub-requirement, type 2.1[ii]. The third vegetation encroachment occurred on June 4, 2019 at 20:51 PDT on transmission line 2L09 mid-span between structures 52/1A and 52/2. The encroachment caused a 4-minute vegetation-related Sustained Outage on a transmission line that is not either an element of an IROL, or an element of a Major WECC Transfer Path; operating within its Rating and all Rated Electrical Operating Conditions in accordance with sub-requirement, type 2.4. The fourth vegetation encroachment occurred on June 7, 2019 at approximately 12:00 PDT on transmission line 2L09 between structures 44/1 and 44/2. The transmission line is not either an element of an IROL, or an element of a Major WECC Transfer Path and was operating within its Rating and all Rated Electrical Operating Conditions in accordance with sub-requirement, type 2.1. **Detailed Discussion of Findings** The BCUC adopted BC Reliability Standard FAC-003-4 on July 26, 2017 in Order Number R-39-17 (Order). The Reliability Standard is introduced and explained beginning on page 292 of 577 of the Order. The Mandatory Effective Date of BC Reliability Standard FAC-003-4 is October 1, 2017. The purpose of Transmission Vegetation Management Reliability Standard FAC-003-4 is "To maintain a reliable electric transmission system by using a defense-in-depth strategy to manage vegetation located on transmission ROW and minimize encroachments from vegetation located adjacent to the ROW, thus preventing the risk of those vegetation-related outages that could lead to Cascading." Requirement R2 states: "Each applicable Transmission Owner and applicable Generator Owner shall manage vegetation to prevent encroachments into the MVCD of its applicable line(s) which are not either an element of an IROL, or an element of a Major WECC Transfer Path." On May 24, 2019 BCHA submitted a FAC-003-4 48-Hour Vegetation-caused Sustained Outage Report. In the report, the BCHA Transmission Owner (TO) declared on May 22, 2019 at 19:43 PDT its 230kV Transmission line 2L09, while loaded at 87% of its normal rating, experienced a 10-minute

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Table 3: Findings and Supporting Evidence
Category 1B sustained vegetation-related Outage. In the detailed description of the outage, BCHA stated: 2L09 and 2L13 are parallel 230kV circuits that run from Cheekye Substation near Squamish to Cypress and Lynn Valley Subs in West and North Vancouver. 2L13 was out of service, at the time of the fault on 2L09, as a planned outage. Following the sustained outage, a 4.5 m tall tree was found with a burnt top in the restricted Greater Vancouver Watershed on Thursday, May 23 and is the presumed cause of the Outage. Category 1B sustained vegetation-related Outages are defined in BC Reliability Standard FAC-003-4 as "Grow-ins: Sustained Outages caused by vegetation growing into applicable lines but are not identified as an element of an IROL or Major WECC Transfer Path, by vegetation inside and/or outside of the ROW." On July 19, 2019 BCHA submitted its second quarter 2019 FAC-003-4 – Vegetation-Caused Sustained Outage Quarterly Report. Quarterly vegetation-caused sustained outage reports are required elements of the Reliability Standard Periodic Data Submittal. In the quarterly report, BCHA declared it experienced a Category 1B — Grow-in outage on its 2L09 230kV transmission line. The 4-minute outage occurred on June 4, 2019 at 20:51. Between July 12, 2019 and August 20, 2019 BCHA performed a Root Cause Analysis (RCA) to better understand the root causes and contributing factors that resulted in the four (4) vegetation encroachments and two (2) vegetation-related sustained outages. BCHA submitted a copy of the RCA with the initial CVI data request. The analysis and study determined vegetation at three (3) locations on transmission line 2L09 and one location on transmission line 2L17 grew within the MVCD of one or more conductors. The RCA determined the primary causes of the four (4) vegetation encroachments, that two (2) vegetation of the four (4) included related transmission line outages was "inexperienced field operators only partially implemented the documented inspection procedures", resulting in "ineffective Vegetation Inspections". Specifically, the field operators underestimated potential line sag and underestimated potential growth of vegetation. On August 21, 2019 BCHA submitted a SRV of FAC-003-4 R2 declaring between May 22, 2019 and June 7, 2019 there were three (3) vegetation encroachments into the MVCD of its 2L09 230kV transmission line and one vegetation encroachment into the MVCD of its 2L17 230kV transmission line. Specific to the encroachment on May 22, 2019 at 19:43 PDT (1st encroachment) BCHA stated: 2L09, CROW Event 8-867233, May 22, 2019 at 19:43 PDT. Outage duration was 10 minutes. 2L09 and 2L13 are parallel 230kV circuits that run from Cheekye Substation near Squamish to Cypress and Lynn Valley Substations in West and North Vancouver. 2L13 was out of service,

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Table 3: Findings and Supporting Evidence

at the time of the fault on 2L09, as a planned outage. The loading on 2L09 at the time of the trip was between 930-940 A or 87% of its normal rating. Following the sustained outage, a 4.5 m tall western hemlock tree was found with a burnt top in the restricted Greater Vancouver Watershed between structures 52/2-52/3 on Thursday, May 23 and is the presumed cause of the outage. An outage request was made for 2L09 to remove trees in the area of concern at the outage site and 2L13 was placed back into service on Friday May 24th to facilitate the outage of 2L09 and tree removals on 2L09.

Specific to the encroachment on June 4, 2019 at approximately 17:00 PDT (2nd encroachment) BCHA stated:

2L17, June 4, 2019 at approximately 17:00 PDT. No forced outage. District of North Vancouver Fire Department responded to a report from a member of the public. The Fire Department attended and they cordoned off the ROW and contacted BC Hydro. The responding line crew found a 7.6 m cottonwood coppice under 2L17 between structures 676-677 that showed evidence of a burnt top and it was removed that evening under live line methods. 2L14 and 2L17 are parallel 230kV circuits on a single lattice structure at the site location. 2L14 runs from Cypress Substation (CYP) to Walters Substation (WLT) and 2L17 runs from Lynn Valley Substation (LYN) to WLT in West and North Vancouver. 2L14 was out of service at the time to facilitate maintenance work at WLT. The loading on 2L17 was between 792 to 940 A or 81-96% of its normal rating.

Specific to the encroachment on June 4, 2019 at 20:51 (3rd encroachment) BCHA stated:

CROW Event 8-368978 June 4, 2019 at 20:51 PDT. Outage duration was 4 minutes. 2L09 Cheekye-Lynn Valley and 2L14 Cypress-Walters are 230kV circuits that run through the Metro Vancouver Capilano Watershed. At the time of the fault on 2L09, 2L14 was out of service as a planned outage for maintenance work at Walters Substation. The loading on 2L09 at the time of the fault was 1093 A or 98% of normal rating. An 8.0 m tall cherry tree was found with a burnt top in the Greater Vancouver Watershed between structures 51/1A-52/2 on Wednesday, June 5th and is the presumed cause of the outage. The tree was removed under a planned outage of 2L09 on June 6, 2019 and the circuit was placed back into service. Detailed air and ground patrols of the 230kV circuits in the Watershed were conducted following this event and scheduled maintenance work in the Capilano Watershed underway after the May 22nd outage was further accelerated.

Specific to the encroachment on June 7, 2019 at approximately 12:00 PDT (4th encroachment) BCHA stated:

2L09, June 7, 2019 at approximately 12:00 PDT. No forced outage. BC Hydro received a report shortly after noon from Metro Vancouver that there was a report of a small fire in the Capilano Watershed within the 230kV ROW. Vegetation staff immediately requested that

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Table 3: Findings and Supporting Evidence

2L09 be de-rated and proceeded to the site of the fire located between structures 44/1-44/2. A 4.5 m tall willow with a burnt top was located midspan under B phase and observed to be 2.3 m from the conductor to tree tip. The peak loading on 2L09 in the previous 24 hours and up to the time of the report of the fire was 557 A or 57% of normal rating. When a line crew arrived after 15:00 PDT it was deemed safe to cut down taller vegetation within the 0.5 ha burn area so that a wildfire crew on site could ensure that the fire was extinguished. As of August 19, 2L09 remains de-rated to 900 A maximum load to facilitate vegetation work in the Watershed before it can be returned to normal service.

During the on-site week, the CVI Team interviewed the crews that responded to the each of the three (3) vegetation encroachment locations on 2L09 and the one vegetation encroachment location on 2L17 between May 22, 2019 and June 7, 2019. During the interviews, the CVI Team confirmed the following:

A 4.5 m hemlock tree encroached the MVCD of Transmission Line 2L09 between structures 52/2 and 52/3 on May 22, 2019 causing a 10-minute vegetation-related Outage. The CVI Team verified the protection systems on transmission line 2L09 operated as designed to properly isolate and contain the vegetation-related sustained outage. No load was lost as a result of the Outage.

A 7.6 m tall cottonwood tree encroached the MVCD of Transmission Line 2L17 between structures 676 and 677 on June 4, 2019. The tree showed evidence of a high voltage flash-over. There was no forced outage. The Fire Department responded to a report from a member of the public and cordoned off the ROW. The encroachment location was within Inter River Park near a hiking trail.

One or more 8.0 m cherry trees encroached the MVCD of Transmission Line 2L09 between structures 52/1A and 52/2 on June 4, 2019 causing a 4-minute vegetation-related sustained Outage. This location is one span from the May 22nd vegetation encroachment. The CVI Team verified the protection systems on transmission line 2L09 operated as designed to properly isolate and contain the vegetation-related sustained outage. There was a brief post-contingency SOL exceedance on 2L90, which is from Bridge River (BRT) to Kelly Lake (KLY). The SOL exceedance was 320 A over the 700 A temperature based rating of 2L90.
The actions taken by the Control Center included both immediate automatic remedial action (generation shedding) and manual 2L9 restoration by the System Operator, which returned 2L90 to 55% of its SOL within 4 minutes. No load was lost as a result of the Outage.

A 4.5 m tall willow tree encroached the MVCD of Transmission Line 2L09 mid-span between structures 44/1 and 44/2 on June 7, 2019. The tree showed evidence of a high voltage flash-over. There was no forced outage. Metro Vancouver notified BCHA about 12:00 PDT of a fire in the Capilano Watershed. The fire department responded and stood by until the BCHA

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Table 3: Findings and Supporting Evidence

contract line crew arrived about 15:00 PDT. The crew removed the taller vegetation at the site and the fire department extinguished the .5-hectare fire in the ROW.

Requirement R2 is a real-time Reliability Requirement; therefore, each of the four (4) vegetation encroachments into the MVCD, is a distinct PV of Requirement R2.

The CVI Team verified during both vegetation-related outages, with the N-1 loss of transmission line 2L09, BCHA continued to operate all remaining in-service BES elements within their designed System Operating Limits (SOLs). BCHA monitored real-time contingency analysis (RTCA) and operated BES assets within criteria set forth by both BCHA's and Peak Reliability's SOL Methodology. At no time during the outage was there danger of cascading or wide spread outages which could have resulted in negative impacts to the Interconnected BES.

The CVI Team asked the BCHA leaders and TVMP managers what actions they took immediately after becoming aware vegetation conditions on two (2) transmission line ROWs in the North Shore Pemberton (NSP) District were not up to BCHA TVMP specifications. The leaders and managers both confirmed that all transmission lines operating at 69kV and above in the NSP District were patrolled by helicopter in early June and ground patrolled between mid-June and mid-August. The CVI Team confirmed BCHA completed its initial air and ground patrols of transmission lines 2L09 and 2L17 by June 10, 2019 and completed span-by-span ground patrols by August 15, 2019. All the corrective action work identified during the patrols in the District were completed by early September.

During the interviews, the CVI Team confirmed BCHA verified transmission line ROWs in the remaining eleven (11) District were inspected by experienced field operators who followed the documented inspection procedures. There were no locations identified during the Vegetation Inspections with vegetation conditions likely to cause an encroachment into the MVCD. The Transmission Vegetation Management leadership and staff confirmed in June and early July 2019, BCHA performed helicopter and ground patrols on its priority transmission line ROWs to ensure the vegetation conditions on the ROWs in all twelve (12) District Offices were being managed consistent with TVMP specifications.

During the interviews, the CVI Team confirmed BCHA performed a final Quality Assurance (QA) Vegetation Inspection after all identified corrective actions had been implemented. The QA Vegetation Inspections were completed on September 4, 2019. The CVI Team learned BCHA spent an incremental $2.5 million on transmission line ROW tasks in the NSP District to restore applicable transmission line ROWs to TVMP specifications.

Internal Control Description and Evaluation:

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Table 3: Findings and Supporting Evidence
Requirement R2 is a Performance-based Requirement. It requires that vegetation be managed to prevent vegetation encroachment inside the Minimum Vegetation Clearing Distance (MVCD). BCHA has an exceptionally well-documented TVMP. The Vegetation Inspection process and corrective action process and supporting procedures account for the movement of applicable line conductors under their Rating and all Rated Electrical Operating Conditions; and the inter-relationships between vegetation growth rates, vegetation control methods, and inspection frequency. This is widely considered a best-practice: however, even a well-documented Vegetation Management Program will experience inconsistent results, if sufficient preventative controls are not implemented. BCHA undertook a root cause analysis (RCA) to learn more about the failure points that contributed to the four (4) vegetation encroachments into the MVCD on transmission lines 2L09 and 2L17. The RCA identified that internal controls are incomplete and were inconsistently applied which led to these encroachments. Although BCHAs TVMP is well documented, the systematic measures and supervisory methods to support the execution of the TVMP were less than adequate. Supervision and evaluation techniques that were used to monitor, direct and control work, need improvement. BCHA TVMP managers candidly shared the RCA information with the CVI Team. The CVI Team explained within the past three (3)-years, there have been several similar instances of vegetation encroaching the MVCD of transmission lines in the Western Interconnection. In each instance, the impacted entity had not implemented a comprehensive QA program to ensure TVMP tasks were being completed to work specifications. In other words, in each instance the impacted entity was not getting the TVMP results it expected. During the on-site interviews, the CVI Team determined BCHA managers and executives understand what needs to be done to ensure no vegetation encroachment into the MVCD occur. The CVI Team was told the Mitigation Plan will include additional internal controls and an enhanced QA process. **Primary Documents Supporting Finding:** [redacted]

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Table 3: Findings and Supporting Evidence

[redacted]

BC Reliability Standard	Requirement	Registered Function	Category of Finding
FAC-003-4	R3	GO, TO	No Finding

Description of Finding

BCHA had documented maintenance strategies or procedures or processes or specifications it used to prevent the encroachment of vegetation into the MVCD of its applicable lines that accounts for criteria under sub-requirements 3.1 and 3.2.

Primary Documents Supporting Finding:

[redacted]

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BC Reliability Standard	Requirement	Registered Function	Category of Finding
FAC-003-4	R5	GO, TO	No Finding
Description of Finding			
BCHA was not constrained from performing vegetation work on an applicable line operating within its Rating and all Rated Electrical Operating Conditions which may lead to a vegetation encroachment into the MVCD prior to the implementation of the next annual work plan. **Primary Documents Supporting Finding**: [redacted]			
BC Reliability Standard	**Requirement**	**Registered Function**	**Category of Finding**
FAC-003-4	R6	GO, TO	Possible Violation
Description of Finding			
Summary Findings Statement BCHA failed to perform a Vegetation Inspection of 100% of its applicable transmission lines (measured in kilometers) at least once per calendar year and with no more than 18-calendar months between inspections on the same ROW.			

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Table 3: Findings and Supporting Evidence
The BCHA vegetation inspections from October 1, 2017 thru June 7, 2019 on lines 2L09 and 2L17 did not account for the movement of applicable transmission line conductors under their Rating and all Rated Electrical Operating Conditions and/or the Inter-relationships between vegetation growth rates, vegetation control methods, and inspection frequency. BCHA failed to perform a systematic examination of vegetation conditions on transmission lines 2L09 and 2L17. The two (2) lines represent 64.13 km of the total 8,532.75 km (.75%) of BC Reliability Standard FAC-003-4 applicable transmission lines in the BCHA BES. **Detailed Discussion of Findings** The BCUC adopted BC Reliability Standard FAC-003-4 on July 26, 2017 in Order Number R-39-17 (Order). The BC Reliability Standard is introduced and explained beginning on page 292 of 577 of the Order. The Mandatory Effective Date of BC Reliability Standard FAC-003-4 is October 1, 2017. The purpose of Transmission Vegetation Management Reliability Standard FAC-003-4 is "To maintain a reliable electric transmission system by using a defense-in-depth strategy to manage vegetation located on transmission ROW and minimize encroachments from vegetation located adjacent to the ROW, thus preventing the risk of those vegetation-related outages that could lead to Cascading." Requirement R6 states, "Transmission and Generator Owners that own applicable transmission lines are required to perform a Vegetation Inspection of 100% of its applicable transmission lines at least once per calendar year and with no more than 18 calendar months between inspections on the same ROW." The BCUC-approved NERC "Glossary of Terms Used in NERC Reliability Standards (dated July 3, 2018)" defines Vegetation Inspection as "The systematic examination of vegetation conditions on a Right-of-Way and those vegetation conditions under the applicable Transmission Owner's or applicable Generator Owner's control that are likely to pose a hazard to the line(s) prior to the next planned maintenance or inspection. This may be combined with a general line inspection." FAC-003-4 Requirement R3 further clarifies a Vegetation Inspection, requiring TOs and GOs to "… have documented maintenance strategies or procedures or processes or specifications it uses to prevent the encroachment of vegetation into the MVCD of its applicable lines that accounts for the following:

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Table 3: Findings and Supporting Evidence

- Movement of applicable line conductors under their Rating and all Rated Electrical Operating Conditions;
- Inter-relationships between vegetation growth rates, vegetation control methods, and inspection frequency."

Therefore, to be a systematic examination of vegetation conditions on a ROW, a Vegetation Inspection must account for the movement of applicable line conductors under all Rated Electrical Operating Conditions and the Inter-relationships between vegetation growth rates, vegetation control methods, and inspection frequency.

The BCHA Vegetation Standard TVMP documentation includes a thoroughly documented transmission Vegetation Inspections procedure titled Vegetation Standard Patrols for Transmission Circuit Vegetation Inspections that establishes the following:

> All applicable circuits have vegetation patrols at least once annually and most are patrolled twice a year, using both aerial and ground inspections.

The Vegetation Inspection procedure is further clarified in Vegetation Standard Transmission Minimum Vegetation Clearance Distances which establishes the following:

> Clearances between vegetation and overhead, ungrounded supply conductors shall take into consideration the effects of transmission line voltage, the effects of ambient temperature on conductor sag under maximum design loading, the effects of wind velocities on conductor sway, the effects of overvoltage surge factors, the effects of snow and ice loading, and local conditions such as current vegetation height and growth rates (vertical and lateral) when prescribing and scheduling vegetation management activities.

The CVI Team confirmed BCHA has a thoroughly documented Vegetation Inspection procedure that includes maintenance strategies, processes and specifications that accounts for the movement of applicable line conductors under their Rating and all Rated Electrical Operating Conditions and the inter-relationships between vegetation growth rates, vegetation control methods, and inspection frequency. The Vegetation Inspection procedure is consistent with the requirements of BC Reliability Standard FAC-003-4 Requirement 3.

The CVI Team determined BCHA performed a Vegetation Inspection of all its applicable transmission lines at least once per calendar year and with no more than 18 calendar months between inspections on the same ROW, except for lines 2L09 an 2L17.

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Table 3: Findings and Supporting Evidence
The CVI Team determined BCHA conducted helicopter patrols of transmission lines 2L09 on or about September 28, 2017, March 12, 2018, June 19, 2018, and September 4, 2018. The CVI Team determined BCHA conducted ground patrols of transmission lines 2L09 and 2L17 on or about September 11, 2018 and March 27, 2019 as well as on August 15, 2018 and March 7-8, 2019. However, soon after the most recent patrols; vegetation encroached the MVCD of Transmission Line 2L09 on May 22, 2019 and June 4, 2019 and June 7, 2019, vegetation encroached the MVCD of Transmission Line 2L17 on June 4, 2019. The helicopter and ground patrols on transmission line 2L09 from September 30, 2017 to March 27, 2019 failed to account for the movement of applicable transmission line conductors under their Rating and all Rated Electrical Operating Conditions. Within three (3) months of the most recent patrol on transmission line 2L09—: • A 4.5 m tall hemlock tree located midspan between structures 52/2 and 52/3 and • a 4.5 m tall willow tree located midspan between structures 44/1 and 44/2 each encroached the MVCD of transmission line 2L09. The ground patrols on transmission line 2L17 from September 30, to March 27, 2019 failed to account for the movement of applicable transmission line conductors under their Rating and all Rated Electrical Operating Conditions. Within three (3) months of the most recent patrol a 7.6 m tall cottonwood tree located midspan between structures 676 and 677 encroached the MVCD of transmission line 2L17. The CVI Team determined BCHA did not perform a systematic examination of vegetation conditions on transmission lines 2L09 and 2L17 ROWs. Specifically, the patrols did not account for the movement of applicable line conductors under all Rated Electrical Operating Conditions and the Inter-relationships between vegetation growth rates, vegetation control methods, and inspection frequency and those vegetation conditions under its control that were likely to pose a hazard to the transmission lines prior to the next planned inspection. The RCA determined the primary causes of the four (4) vegetation encroachments of which two (2) were vegetation-related transmission line outages due to "inexperienced field operators only partially implemented the documented inspection procedures", resulting in "ineffective Vegetation Inspections." Specifically, the field operators underestimated potential line sag and underestimated potential growth of vegetation.

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Table 3: Findings and Supporting Evidence
During the on-site week, the CVI Team interviewed the crews that performed the helicopter and ground patrols on transmission lines 2L09 and 2L17 between September 28, 2017 and March 27, 2019. The CVI Team also interviewed BCHA vegetation managers and executives responsible for its Transmission Vegetation Management Program. During the interviews, the CVI Team confirmed the helicopter and ground vegetation inspections from September 28, 2017 to March 27, 2019 were ineffective because the personnel in the North Shore Pemberton District who performed the inspections were inexperienced and did not thoroughly follow the documented inspection procedures. As a result, the inspectors underestimated potential line sag and underestimated potential growth rates of the vegetation in the two (2) transmission line ROWs. The CVI Team asked the BCHA leaders and TVMP managers what actions they took immediately after becoming aware vegetation conditions on two (2) transmission line ROW in the NSP District were not up to BCHA TVMP specifications. The leaders and managers both confirmed that all transmission lines 69kV and above in the District were patrolled by helicopter in early June and ground patrolled between mid-June and mid-August. The CVI Team confirmed BCHA completed its initial air and ground patrols of transmission lines 2L09 and 2L17 by June 10, 2019 and completed span-by-span ground patrols by August 15, 2019. All the corrective action work in the District was completed in early September. During the interviews, the CVI Team confirmed BCHA verified transmission line ROWs in the remaining eleven (11) Districts were inspected by experienced field operators who followed the documented inspection procedures and that there were no locations identified during Vegetation Inspections with vegetation conditions likely to cause an encroachment into the MVCD. The TVMP leaders and managers confirmed in June and early July 2019, BCHA performed helicopter and ground patrols on its priority transmission line ROWs to ensure the vegetation conditions on the ROWs in all twelve (12) District locations were being managed consistent with its TVMP specifications. During the interviews the CVI Team confirmed BCHA performed a final QA Vegetation Inspection after all identified corrective actions had been implemented. The QA Vegetation Inspections were completed on September 4, 2019. The CVI Team learned BCHA spent an incremental $2.5 million on transmission line ROW tasks in the NSP District to restore the ROWs to its TVMP specification. **Internal Control Description and Evaluation**: Requirement R6 is a Risk-based requirement. It requires a Vegetation Inspection of 100% of applicable transmission lines at least once per calendar year and with no more than 18-calendar months between inspections on the same ROW. In its response in Q3.pdf, BCHA stated, "All applicable circuits have vegetation patrols at least once annually and most are patrolled twice a year, using both aerial and ground inspections." The CVI Team is aware that the BCHA's current version of its TVMP to include a third Vegetation Inspection

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Table 3: Findings and Supporting Evidence
on transmission lines with ROWs in locations with fast-growing vegetation. This preventative control is designed to identity fast-growing vegetation before the next growing season. BCHA has well-documented Vegetation Inspection procedures and work practices. This detective control is designed to give personnel who perform Vegetation Inspections consistent tools and promote consistent work practices while performing inspections. Prior to last summer, BCHA hired Certified Utility Arborists and believed their TVMP job skills were sufficient without further verification. Management practices lacked formal checks to ensure workers who performed Vegetation Inspections understood their tasks and responsibilities and TVMP managers lacked sufficient measures to monitor worker performance. Each of these factors contributed to Vegetation Inspections where potential line sag and potential growth of vegetation were underestimated. BCHA needs to develop additional detective and preventative controls to ensure field personnel have the skill set and tools to perform Vegetation Inspections consistent with BCHA work specifications. BCHA should implement a comprehensive quality assurance program to verify Vegetation Inspections (and other TVMP tasks) are being performed consistent with BCHAs well documented work specifications. **Primary Documents Supporting Finding:** [redacted]

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Table 3: Findings and Supporting Evidence
[redacted]

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Areas of Concern, Recommendations, and Positive Observations

Areas of Concern

The CVI Team did not identify an area of concern.

Recommendations

The CVI Team did not identify any recommendations.

Positive Observations:

The CVI Team had uninterrupted cooperation from and the full attention of BCHAs leadership team and staff. All BCHA SMEs, compliance personnel and vegetation management contractors were cooperative, complete, and consistent in their responses to CVI Team questions during the three-day on-site interviews. The senior executives responsible for the TVMP participated in the CVI with their managers and SMEs.

BCHA responses to multiple CVI Team data requests were timely and complete.

BCHA undertook a root cause analysis (RCA) shortly after the four (4) vegetation encroachments to learn more about TVMP failure points. TVMP managers and Compliance staff candidly shared the output of the RCA process with the CVI Team. As a result, the Managers and Compliance staff have a deeper understanding of the contributing factors that led to the four (4) Vegetation encroachments into the MVCD on two (2) transmission lines and appear to be using this information to construct and implement improvement plans and additional performance measures for its Vegetation Management Program.

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Compliance Culture

BCHA's compliance culture was not formally reviewed by the CVI Team as part of the CVI Assessment of BCHA's internal compliance program.

WECC Contact Information

Any questions regarding this Compliance Violation Investigation report can be directed to:

WECC

155 North 400 West, Suite 200

Salt Lake City, UT 84103

On behalf of WECC, this report was prepared and reviewed by:

Compliance Violation Investigation Team Lead	Date
Compliance Auditor	March 19, 2020
Management Representative	**Date**
Director of Compliance Monitoring	March 19, 2020
Legal Representative	**Date**
Senior Legal Counsel	March 19, 2020

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Appendix 1: Compliance Violation Investigation Participants

Appendix Table 1: Compliance Violation Investigation Team and Appendix Table 2: BCHA Participants list all personnel from the CVI Team and BCHA who were directly involved during the meetings and interviews. *Names of individuals have been redacted.*

Appendix Table 1: Compliance Violation Investigation Team

Role	Title	Entity
Team Lead	Compliance Auditor	WECC
Team Member	Senior Compliance Auditor	WECC
Team Member	Manager, Compliance Monitoring, O&P	WECC
Team Member	WECC Compliance Consultant	WECC
Documentation	Compliance Program Coordinator	WECC
Observer	International Relations Manager	WECC
Observer	Senior Legal Counsel	WECC

Appendix Table 2: BCHA Participants

Title	Entity
Director of Transmission & Planning	BCHA
Director of Asset Strategy & Planning	BCHA
Acting Transmission Vegetation Manager	BCHA
Director of Projects, Program & Contract Management	BCHA
Executive Vice-President, Operations	BCHA
Vancouver Island/Sunshine Coast Operations Manager	BCHA
Distribution Vegetation Manager	BCHA
Distribution Vegetation Coordinator, North Shore Pemberton	BCHA
Chief Regulatory Officer	BCHA
Acting Portfolio Manager	BCHA
Vegetation Coordinator: Okanagan Shuswap	BCHA
Vegetation Work Planning and Process Coordinator	BCHA
Transmission Vegetation Coordinator, PG	BCHA
North Vancouver Island/Sunshine Coast Transmission Vegetation Coordinator	BCHA
Transmission Vegetation Coordinator, North Shore Pemberton	BCHA
Senior Solicitor & Counsel	BCHA
Senior Vice-President, Integrated Planning	BCHA
Acting Lower Mainland Operations Manager	BCHA
Reliability Compliance Manager	BCHA
Vegetation Program Manager	BCHA

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Appendix Table 2: BCHA Participants	
Title	Entity
Registered Professional Forester	Chartwell Consulting
Registered Professional Forester	Hedberg and Associates
External Legal	Lawson Lundell

MISC Information: As of the date of the four (4) vegetation encroachments, the Reliability Coordinator for BCHA was PeakRC.

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Attachment A: Glossary of Terms

Administrator

A knowledgeable party that the Commission has appointed to act as Administrator for the purposes identified in the Rules of Procedure and the attached Registration Manual and Compliance Monitoring Program.

Altitude Correction Factor

A multiplier applied to specify distances, which adjusts the distances to account for the change in relative air density (RAD) due to altitude from the RAD used to determine the specified distance. Altitude correction factors apply to both minimum worker approach distances and to minimum vegetation clearance distances.

Area of Concern (AOC)

A situation that does not appear to involve a current or ongoing violation of a BC Reliability Standard requirement, but instead represents a situation or practice that could become a violation if not corrected.

British Columbia Hydro and Power Authority (BCHA)

BCHA is a British Columbia provincial Crown corporation, and one of the largest electric utilities in Canada. The company's mandate is to generate, purchase, transmit, distribute, and sell electricity.

BC Mandatory Reliability Standard FAC-003-4

Version 4 of the Transmission Vegetation Management Reliability Standard that became applicable to Transmission Owners and Generation Owners in British Columbia on October 1, 2017. The purpose of the Standard is to maintain a reliable electric transmission system by using a defense- in-depth strategy to manage vegetation located on transmission rights of way (ROW) and minimize encroachments from vegetation located adjacent to the ROW, thus preventing the risk of those vegetation-related outages that could lead to Cascading.

British Columbia Utilities Commission (BCUC)

The BCUC is an independent agency of the Government of British Columbia that is responsible for regulating BC's energy utilities, the Insurance Corporation of BC's compulsory automobile insurance rates, intra-provincial pipelines, and the reliability of the electrical transmission grid.

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BCUC Compliance Monitoring Program (CMP)

The purpose of the Compliance Monitoring Program is to monitor and assess compliance with Reliability Standards.

BCUC Rules of Procedure (ROP)

The BCUC has developed the Rules of Procedure to facilitate the administration of Reliability Standards.

Bonneville Power Authority (BPA)

A U.S.A. neighboring Balancing Authority, Transmission Owner and Transmission Operator that is interconnected with BCHA with two (2) 500kV and one 230kV transmission lines (WECC Path 3).

Bulk Electric System (BES)

All Transmission Elements (unless modified by the lists shown in the NERC Glossary of Terms) operated at 100 kV or higher and Real Power and Reactive Power resources connected at 100 kV or higher. This does not include facilities used in the local distribution of electric energy.

Cascading

The uncontrolled successive loss of System Elements triggered by an incident at any location. Cascading results in widespread electric service interruption that cannot be restrained from sequentially spreading beyond an area predetermined by studies.

Clearance 1 – Operational Clearance

A BCHA term that describes the operational maintenance conductor to vegetation clearance limits for operating voltages from 69kV to 500 KV. BCHA Transmission Minimum Vegetation Clearance Distances Standard VS-03.10 states "Vegetation will be maintained to achieve Clearance 1 limits (Table 1) at all times, wherever practicable. Where Clearance 1 levels cannot be maintained, risk mitigation measures must be developed and implemented as per Vegetation Standard VS-03.40 Vegetation Risk Mitigation." The BCHA Clearance 1 distance for a 230kV transmission line is 4.5 m. The Standard further states: "For maintenance efficiency, wherever practicable, vegetation should be controlled before it reaches the Clearance 1 limits. Actual site clearances shall take into account the local conditions and the vegetation maintenance return cycle." BC Hydro has chosen to set Clearance 1 limits equivalent to those in Column 2,

minimum approach distance for working close to exposed electrical equipment or conductors, of Table 19-1A of the WorkSafe BC Electrical Safety Regulations.

Clearance 2 – Minimum Clearance

A BCHA term that describes the minimum conductor to vegetation radial clearance requirements for operating voltages from 69kV to 500kV. BCHA Transmission Minimum Vegetation Clearance Distances Standard VS-03.10 states "Minimum conductor to vegetation radial clearance shall be maintained at all times to prevent flashover on energized transmission circuits based on their operating voltage (Table 2). If these limits are observed to be violated, immediate remedial action must be undertaken through use of Vegetation Standard VS-03.30 Imminent Threat." The BCHA Clearance 2 distance for a 230kV transmission line is 1.5 m. Clearance 2 distances for this standard are based on BC Hydro Engineering Standard ES41K, Electrical Clearances for Overhead Transmission Lines, which adheres to and is partially derived from the Canadian Standards Association standard CAN/CSA-C22.3-No. 1-06, Overhead Systems. Clearance 2 limits are set as equivalent to ES41K Table A2, Voltage-Withstand Distances Used for Clearance Requirements. The calculated 'Voltage-Withstand Distance' is defined as the gap (vertical clearance for operating lines) which would not experience flashover when transient surge voltages are applied.

Compliance Monitor

The entity that monitors, reviews, and ensures compliance of responsible entities with reliability standards. The Compliance Monitor in British Columbia is the BCUC.

Compliance Violation Investigation (CVI)

A comprehensive investigation, which may include an on-site visit with interviews of the appropriate personnel, to determine if a violation of a Reliability Standard has occurred.

Control Center (CC)

One or more facilities hosting operating personnel that monitor and control the Bulk Electric System (BES) in real-time to perform the reliability tasks, including their associated data centers, of: 1) a Reliability Coordinator, 2) a Balancing Authority, 3) a Transmission Operator for transmission Facilities at two or more locations, or 4) a Generator Operator for generation Facilities at two or more locations.

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CROW Event

Control Room Operations Window (CROW) is a BCHA Control Center software application that logs BES events and bursts e-mails about events to pre-identified BCHA staff and contractors. For purposes of this CVI Report, events include transmission line forced outages and transmission line protection systems operations.

Delayed Fault Clearing

Fault clearing consistent with correct operation of a breaker failure protection system and its associated breakers, or of a backup protection system with an intentional time delay.

Emergency Rating

The rating as defined by the equipment owner that specifies the level of electrical loading or output, usually expressed in megawatts (MW) or Mvar or other appropriate units, that a system, facility, or element can support, produce, or withstand for a finite period. The rating assumes acceptable loss of equipment life or other physical or safety limitations for the equipment involved.

Facility

A set of electrical equipment that operates as a single Bulk Electric System Element (e.g., a line, a generator, a shunt compensator, transformer, etc.)

Facility Rating

The maximum or minimum voltage, current, frequency, or real or reactive power flow through a facility that does not violate the applicable equipment rating of any equipment comprising the facility.

Fault

An event occurring on an electric system such as a short circuit, a broken wire, or an intermittent connection.

Flashover

An electrical discharge through air around or over the surface of insulation, between objects of different potential, caused by placing a voltage across the air space that results in the ionization of the air space

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Forced Outage

1. The removal from service availability of a generating unit, transmission line, or other facility for emergency reasons.
2. The condition in which the equipment is unavailable due to unanticipated failure.

Generator Owner (GO)

Entity that owns and maintains generating Facility(ies).

Glossary of Terms Used in NERC Reliability Standards, July 3, 2018

The July 3, 2018 version of the NERC Glossary of Terms Used in the NERC Reliability Standards is the most recent approved version adopted for use in British Columbia. It was adopted with BCUC Order Number R-21-19 on September 26, 2019.

Independent Power Producer (IPP)

Any entity that owns or operates an electricity generating facility that is not included in an electric utility's rate base. This term includes, but is not limited to, co-generators and small power producers and all other nonutility electricity producers, such as exempt wholesale generators, who sell electricity.

Interconnection Reliability Operating Limit (IROL)

A System Operating Limit that, if violated, could lead to instability, uncontrolled separation, or Cascading outages that adversely impact the reliability of the Bulk Electric System.

Interconnection

A geographic area in which the operation of Bulk Power System components is synchronized such that the failure of one or more of such components may adversely affect the ability of the operators of other components within the system to maintain Reliable Operation of the Facilities within their control. When capitalized, any one of the four major electric system networks in North America: Eastern, Western, ERCOT and Quebec. BCHA lies entirely within the Western Interconnection.

Limit of Approach Distance. (LOA)

A BCHA term equivalent to the WorkSafe BC G19.24.1 term "Minimum approach distance". Table 19-1A of the WorkSafe BC Electrical Safety Regulations Column 2 "Minimum approach distance for working close to exposed electrical equipment or conductors" for a Phase to Phase

operating Voltage of 230kV is 4.5 Meters. BCHA has chosen to set its TVMP Clearance 1 limits equivalent to the WorkSafe BC Electrical Safety Regulation minimum approach distance for all operating voltages above 69kV.

Mandatory Reliability Standards (MRS)

A Reliability Standard as defined in section 125.2(1) of the UCA that has been adopted by the Commission under section 125.2(6) of the UCA for application in British Columbia. A Reliability Standard normally consists of the following components: (i) Introduction; (ii) Requirements; and (iii) Measures. A Reliability Standard does not include Compliance Provisions

Minimum Vegetation Clearance Distance (MVCD)

The calculated minimum distance stated in feet (meters) to prevent flash-over between conductors and vegetation, for various altitudes and operating voltages. The MVCD is a calculated minimum distance that is derived from the Gallet equation. This is a method of calculating a flash over distance that has been used in the design of high voltage transmission lines. Keeping vegetation away from high voltage conductors by this distance will prevent voltage flash-over to the vegetation. See the explanatory text below for Requirement R3 and associated Figure 1. Table 2 of the Standard provides MVCD values for various voltages and altitudes. The table is based on empirical testing data from EPRI as requested by FERC in Order No. 777.

Normal Rating

The rating as defined by the equipment owner that specifies the level of electrical loading, usually expressed in megawatts (MW) or other appropriate units that a system, facility, or element can support or withstand through the daily demand cycles without loss of equipment life.

North Shore Pemberton (NSP)

One of twelve (12) Operating Districts comprising the geographic area of BCHA. The District is part of the Lower Mainland Region and encompasses the area North and West Vancouver and north to Pemberton.

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Possible Violation (PV)

A possible failure by an Entity to comply with a Reliability Standard that it is required to comply with and which may be under investigation by the Administrator. Refer to Alleged Violation for process details.

Protection System

- Protective relays which respond to electrical quantities,
- Communications systems necessary for correct operation of protective functions
- Voltage and current sensing devices providing inputs to protective relays,
- Station dc supply associated with protective functions (including station batteries, battery chargers, and non-battery-based dc supply), and
- Control circuitry associated with protective functions through the trip coil(s) of the circuit breakers or other interrupting devices.

Reliability Coordinator (RC)

The entity that is the highest level of authority who is responsible for the Reliable Operation of the Bulk Electric System, has the Wide Area view of the Bulk Electric System, and has the operating tools, processes, and procedures, including the authority to prevent or mitigate emergency operating situations in both next-day analysis and real-time operations. The Reliability Coordinator has the purview that is broad enough to enable the calculation of Interconnection Reliability Operating Limits, which may be based on the operating parameters of transmission systems beyond any Transmission Operator's vision.

Right-of-Way (ROW)

The corridor of land under a transmission line(s) needed to operate the line(s). The width of the corridor is established by engineering or construction standards as documented in either construction documents, pre-2007 vegetation maintenance records, or by the blowout standard in effect when the line was built. The ROW width in no case exceeds the applicable Transmission Owner's or applicable Generator Owner's legal rights but may be less based on the aforementioned criteria.

Self-Reported Violation (SRV)

Information prepared by an Entity pursuant to section 2.5 of the CMP identifying a Possible Violation of a Reliability Standard, based on the Entity's own assessment, and any actions that were taken or will be taken to resolve the Possible Violation.

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Subject Matter Expert (SME)

A subject matter expert is an individual who has proven knowledge over a particular area or topic.

Sustained Outage

The deenergized condition of a transmission line resulting from a fault or disturbance following an unsuccessful automatic reclosing sequence and/or unsuccessful manual reclosing procedure.

System Operating Limit (SOL)

The value (such as MW, MVAR, amperes, frequency, or volts) that satisfies the most limiting of the prescribed operating criteria for a specified system configuration to ensure operation within acceptable reliability criteria. System Operating Limits are based upon certain operating criteria. These include, but are not limited to:

- Facility Ratings (applicable pre- and post-Contingency Equipment Ratings or Facility Ratings)
- transient stability ratings (applicable pre- and post- Contingency stability limits)
- voltage stability ratings (applicable pre- and post-Contingency voltage stability)
- system voltage limits (applicable pre- and post-Contingency voltage limits)

Transmission

An interconnected group of lines and associated equipment for the movement or transfer of electric energy between points of supply and points at which it is transformed for delivery to customers or is delivered to other electric systems.

Transmission Line

A system of structures, wires, insulators, and associated hardware that carry electric energy from one point to another in an electric power system. Lines are operated at relatively high voltages varying from 69kV up to 765 kV and are capable of transmitting large quantities of electricity over long distances.

Transmission Owner

The entity that owns and maintains transmission Facilities.

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Transmission Vegetation Management Program (TVMP)

The documented maintenance strategies or procedures or processes or specifications to prevent the encroachment of vegetation into the MVCD of a TOs or GOs applicable lines that accounts for the following:

3.1. Movement of applicable line conductors under their Rating and all Rated Electrical Operating Conditions;
3.2. Inter-relationships between vegetation growth rates, vegetation control methods, and inspection frequency.

Vegetation

All plant material, growing or not, living or dead.

Vegetation encroachment

Vegetation within the altitude adjusted minimum vegetation clearance distance (MVCD) of an applicable transmission line. BC Reliability Standard FAC-003-4 requires Transmission Owners (TO) and Generation Owners (GO) that own applicable transmission lines to manage vegetation to prevent encroachment within the MVCD of its transmission lines.

Vegetation Inspection

The systematic examination of vegetation conditions on a right-of-way and those vegetation conditions under the applicable Transmission Owner's or applicable Generator Owner's control that are likely to pose a hazard to the line(s) prior to the next planned maintenance or inspection. This may be combined with a general line inspection.

Western Electricity Coordinating Council (WECC)

WECC is a not-for-profit organization that works to effectively and efficiently mitigate risks to the reliability and security of the Western Interconnection's Bulk Power System. Under the Administration Agreement between BCUC and WECC, WECC acts as the BCUC's Administrator to carry out registration reviews and compliance activities relating to the BC MRS Program.

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[i] An encroachment due to vegetation growth into the line MVCD that caused a vegetation-related Sustained Outage.
[ii] An encroachment into the MVCD, observed in real-time, absent a Sustained Outage.

~~CONFIDENTIAL~~
Heather M. Laws
Director, Enforcement and Mitigation
hlaws@wecc.org · 801-819-7642

Electric Reliability and Security for the West

~~CONFIDENTIAL~~

April 8, 2022

VIA EMAIL

Patricia Robertson
Reliability Compliance Manager
British Columbia Hydro and Power Authority

Subject: Second Revised Notice of Alleged Violations (NOAV)

Patricia Robertson,

I. Introduction

In accordance with Section 4.3.1 of the British Columbia Utilities Commission (BCUC) Compliance Monitoring Program (CMP), the Western Electricity Coordinating Council (WECC) hereby notifies British Columbia Hydro and Power Authority (BCHA) WCR0003 of Alleged Violations of the following BCUC Reliability Standards.

Reliability Standard, Requirement	WECC Tracking Identification Number
FAC-003-4 R2	BCUC2019000681
FAC-003-3 R2	BCUC2020000724
FAC-003-3 R2	BCUC2020000725
FAC-003-4 R2	BCUC2020000726
FAC-003-4 R2	BCUC2020000733
FAC-003-4 R2	BCUC2020000734
FAC-003-4 R2	BCUC2020000735
FAC-003-4 R4	BCUC2020000727
FAC-003-4 R6	BCUC2020000728
FAC-003-4 R7	BCUC2020000729

II. Procedures for Response to this Notice

WECC is notifying BCHA of its rights under Section 4.4 of the CMP, that is has thirty (30) days to respond to this NOAV. This response shall be submitted to the BCUC and WECC. If BCHA fails to respond within 30 days, the BCUC may consider the Alleged Violations in the absence of a submission from BCHA.

BCHA has three (3) options in responding to this NOAV:

1. For each Alleged Violation, BCHA may agree with the Alleged Violation and make no submission on the proposed penalty amount, and agree to submit and implement a Mitigation Plan to correct the Alleged Violation and its underlying causes, in accordance with Section 5.0 of the CMP; or

2. BCHA may agree with the Alleged Violations and make a submission on points relevant to the proposed penalty amount, provide an explanation of its position, and include any supporting information; or

3. BCHA may contest the Alleged Violations, provide an explanation of its position, and include any supporting information.

If BCHA elects Option 1, the Commission will issue an Order confirming the Alleged Violations and follow the penalty process approved by the Commission for determination regarding the proposed penalty amount.

If BCHA elects Option 2, the Commission will review the explanation of BCHA's position regarding the proposed penalty amount and issue an order confirming the Alleged Violations and make a determination regarding the proposed penalty amount.

If BCHA elects Option 3, WECC will review the explanation of BCHA's position, and:

- If WECC agrees with or does not object to BCHA's position on some or all of the contested violation(s), within sixty (60) days of receiving the response to the NOAV, WECC will withdraw the original NOAV and may issue a revised NOAV, or

- If WECC disagrees with or objects to BCHA's position on all of the contested violation(s), WECC will, within sixty (60) days, issue a letter to the Commission and BCHA affirming the NOAV.

BCHA has thirty (30) days to respond to the revised NOAV. Responses are to be submitted to the Commission and WECC. If BCHA fails to respond within thirty (30) days, the Commission may consider the Alleged Violations in the absence of a submission from BCHA.

If BCHA agrees with the revised NOAV and agrees to submit and implement a Mitigation Plan to correct the Alleged Violations and related underlying cause(s) in accordance with Section 5.0, the Commission will issue an Order confirming the Alleged Violations.

Where BCHA contests the revised NOAV, it may provide an explanation of its position and any supporting documentation.

If BCHA contests the revised NOAV, or WECC affirms the NOAV, the Commission will hold a Hearing.

BCHA's response to this Notice, and any related documents, should be submitted through the webCDMS document repository or by using the WECC Workspaces file transfer application.

III. Submission of a Mitigation Plan

WECC is notifying BCHA of its rights under Section 5.1.2 of the CMP; BCHA may elect to prepare a Mitigation Plan while contesting the Alleged Violations. The preparation, submission or implementation of a Mitigation Plan will not be an admission of the Alleged Violations. In the event the BCUC dismisses the Alleged Violations, BCHA is not required to continue to prepare or implement the Mitigation Plans. WECC has been providing Mitigation Assistance to BCHA by working directly with BCHA staff to create comprehensive Mitigation Plans for the Alleged Violations. WECC does not expect the BCUC to compel BCHA to submit its Mitigation Plans, due to the ongoing Mitigation Assistance provided by WECC.

IV. Confidentiality

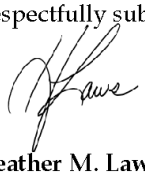
Pursuant to Section 4.3.1 of the CMP, a NOAV will be treated as confidential unless and until the Commission confirms each Alleged Violation as a Confirmed Violation and the Commission considers

that disclosure would not relate to a cyber-security incident or otherwise jeopardize the security of the Bulk Electric System (BES).

V. Conclusion

WECC is sending a copy of this NOAV and the Attachment to the BCUC. Please direct any questions regarding this Notice to Katherine Bennett, Senior Enforcement and Mitigation Analyst, at 801-883-6850 or kbennett@wecc.org. In any correspondence, please provide the name and contact information of a BCHA representative who is authorized to address the Alleged Violations listed herein and the relevant Violation Tracking Identification Numbers.

Respectfully submitted,



Heather M. Laws
Director, Enforcement and Mitigation

cc: Nicole Manalili, Regulatory Analyst, Compliance and Mandatory Reliability Standards
Patrick Wruck, BCUC Commission Secretary

Attachment 1: Information Supporting the Alleged Violations
Attachment 2: Compliance Violation Investigation Report

Attachment 1: Information Supporting the Alleged Violations

Table 1	
British Columbia Hydro and Power Authority (BCHA)	
Registered as: BA, DP, GOP, GO, PA, RP, TOP, TO TP, TSP	
BCUC Compliance Registry ID #: WCR0003	
WECC Violation #: BCUC2019000681	
Reliability Standard Violated	FAC-003-4
Requirement Violated	R2.4
Date of Discovery	05/23/2019
Discovery Method	Self-Report
Period of Violation	May 22, 2019 – May 24, 2019
WECC Violation #: BCUC2020000724	
Reliability Standard Violated	FAC-003-4
Requirement Violated	R2.1
Date of Discovery	6/4/2019
Discovery Method	Self-Report
Period of Violation	June 4, 2019 – June 4, 2019
WECC Violation #: BCUC2020000725	
Reliability Standard Violated	FAC-003-4
Requirement Violated	R2.4
Date of Discovery	6/4/2019
Discovery Method	Self-Report
Period of Violation	June 4, 2019 – June 6, 2019
WECC Violation #: BCUC2020000726	
Reliability Standard Violated	FAC-003-4
Requirement Violated	R2.1
Date of Discovery	6/7/2019
Discovery Method	Self-Report
Period of Violation	June 7, 2019 – June 7, 2019
WECC Violation #: BCUC2020000727	
Reliability Standard Violated	FAC-003-4
Requirement Violated	R4
Date of Discovery	5/15/2020
Discovery Method	Investigation
Period of Violation	June 5, 2019 – June 6, 2019

1

WECC Violation #: BCUC20200007278	
Reliability Standard Violated	FAC-003-3
Requirement Violated	R6
Date of Discovery	5/15/2020
Discovery Method	Investigation
Period of Violation	September 28, 2017 – ongoing
WECC Violation #: BCUC2020000729	
Reliability Standard Violated	FAC-003-4
Requirement Violated	R7
Date of Discovery	5/15/2020
Discovery Method	Investigation
Period of Violation	April 1, 2019 – June 6, 2019
WECC Violation #: BCUC2020000733	
Reliability Standard Violated	FAC-003-4
Requirement Violated	R2.4
Date of Discovery	06/25/2020
Discovery Method	Self-Report
Period of Violation	June 25, 2020 – June 26, 2020
WECC Violation #: BCUC2020000735	
Reliability Standard Violated	FAC-003-4
Requirement Violated	R2.4
Date of Discovery	07/28/2020
Discovery Method	Self-Report
Period of Violation	July 28, 2020 – July 29, 2020
WECC Violation #: BCUC2020000734	
Reliability Standard Violated	FAC-003-4
Requirement Violated	R2.4
Date of Discovery	07/29/2020
Discovery Method	Self-Report
Period of Violation	July 29, 2020 – July 30, 2020
Facts and Evidence of the Act or Practice Resulting in the Alleged Violations	

AFFECTED MANDATORY RELIABILITY STANDARDS:

FAC-003-4 R2

R2. *Each applicable Transmission Owner and applicable Generator Owner shall manage vegetation to prevent encroachments into the MVCD of its applicable line(s) which are not either an element of an IROL, or an*

element of a Major WECC Transfer Path; operating within its Rating and all Rated Electrical Operating Conditions of the types shown below:

2.1. *An encroachment into the MVCD, observed in Real-time, absent a Sustained Outage,10*

2.2. *An encroachment due to a fall-in from inside the ROW that caused a vegetation-related Sustained Outage,*

2.3. *An encroachment due to the blowing together of applicable lines and vegetation located inside the ROW that caused a vegetation-related Sustained Outage,*

2.4. *An encroachment due to vegetation growth into the line MVCD that caused a vegetation-related Sustained Outage.*

FAC-003-4 R4

R4: *Each applicable Transmission Owner and applicable Generator Owner, without any intentional time delay, shall notify the control center holding switching authority for the associated applicable line when the applicable Transmission Owner and applicable Generator Owner has confirmed the existence of a vegetation condition that is likely to cause a Fault at any moment.*

FAC-003-3 R6

R6. *Each applicable Transmission Owner and applicable Generator Owner shall perform a Vegetation Inspection of 100% of its applicable transmission lines (measured in units of choice - circuit, pole line, line miles or kilometers, etc.) at least once per calendar year and with no more than 18 calendar months between inspections on the same ROW.*

FAC-003-4 R7

R7. Each applicable Transmission Owner and applicable Generator Owner shall complete 100% of its annual vegetation work plan of applicable lines to ensure no vegetation encroachments occur within the MVCD. Modifications to the work plan in response to changing conditions or to findings from vegetation inspections may be made (provided they do not allow encroachment of vegetation into the MVCD) and must be documented. The percent completed calculation is based on the number of units actually completed divided by the number of units in the final amended plan (measured in units of choice - circuit, pole line, line miles or kilometers, etc.).

BACKGROUND:

On August 5, 2010, the British Columbia Utilities Commission ("BCUC") issued Order G-128-10. In G-128-10, the BCUC ordered registration for British Columbia Hydro and Power Authority for Balancing Authority (BA), Distribution Provider (DP), Planning Authority (PA), Transmission Operator (TOP), Transmission Owner (TO), Transmission Planner (TP), Transmission Service Provider (TSP). These Standards apply to a TO, therefore, BCHA is subject to this Reliability Standard.

DISCOVERY METHODS:

On August 21, 2019, BCHA submitted a Self-Report stating possible noncompliance with FAC-003-4 R2 given WECC Violation # BCUC2019000681, # BCUC2020000724, # BCUC2020000725 and # BCUC2020000726.

WECC conducted an Investigation of BCHA on October 1, 2019 through May 15, 2020 finding additional instances of possible noncompliance with, FAC-003-4 R4 WECC Violation # BCUC2020000727, FAC-003-3 R6 WECC Violation # BCUC2020000728, and FAC-003-4 R7 WECC Violation # BCUC2020000729.

On August 24, 2020, BCHA submitted a Self-Report stating possible noncompliance with FAC-003-4 R2 WECC Violation # BCUC2020000733.

On September 14, 2020, BCHA submitted Self-Reports stating two instances of possible noncompliance with FAC-003-4 R2 WECC Violation # BCUC2020000734 and # BCUC2020000735.

As a result, WECC assessed that BCHA had seven Alleged Violations of FAC-003-4 R2, one Alleged Violation of FAC-003-4 R4, one Alleged Violation of FAC-003-3 R6 and one Alleged Violation of FAC-003-4 R7, for a total of 10 Alleged Violations of the FAC-003 Standards and Requirements.

VIOLATION FACTS:

NERC Reliability Standard FAC-003-4 R2.4, May 22, 2019
WECC Violation #BCUC2019000681

Facts and Circumstances:

On May 22, 2019, BCHA experienced a Sustained Outage caused by a vegetation encroachment from a Western Hemlock tree into the Minimum Vegetation Clearing Distance (MVCD) on a 230kV transmission line that had a parallel line 230 kV transmission line; however, the parallel line was out of service for a planned outage and could not have provided redundancy for the outage. BCHA found the tree with burned tips, which was determined to be evidence of the outage. The outage lasted 10 minutes, from 7:34 PM until 7:44 PM.

The violation began on May 22, 2019 when the Western Hemlock tree encroached the 230 kV line that led to the Sustained Outage and it ended on May 24, 2019, when the line was placed out of service and BCHA removed the burned tree, for a total of three days.

Root Cause Analysis:
The root cause of this violation was attributed to BCHA's inadequate systematic examination of vegetation conditions that were likely to pose a hazard to the transmission lines prior to the next planned maintenance or inspection. Specifically, as demonstrated by the violation, BCHA did not understand the vegetation growth rates and patterns for this Western Hemlock tree. Though BCHA had a well-documented Transmission Vegetation Management Program (TVMP), BCHA did not provide adequate training for its staff to ensure that systematic measurement of vegetation and supervisory methods of the inspections were executed properly. Inexperienced field personnel partially implemented the procedures in the TVMP and underestimated potential line sag and potential growth rate of vegetation. This first instance of noncompliance with R2 demonstrated that the basis for the root cause of BCHA's systemic and programmatic failure with FAC-003 was its failure to complete adequate Vegetation Inspections of its applicable lines, as required by FAC-003-4 R6.

Reliability Risk Assessment:
In this instance, harm did occur when BCHA failed to manage a Western Hemlock tree to prevent an encroachment into the MVCD of its applicable 230 kV transmission line, which was not either an element of an IROL, or an element of a Major WECC Transfer Path that caused a vegetation-related Sustained Outage, as required by FAC-003-3 R2.4.

Such failure resulted in a Sustained Outage on a 230kV transmission line that lasted for 10 minutes and could have caused the loss of one or more Bulk Electric System (BES) circuits or the loss of generation. The transmission line did have a parallel 230 kV transmission line however, the parallel line was out of service during the outage, which could have resulted in cascading or widespread outages.

As compensation, the 230kV transmission line was not a WECC Major Transfer Path. BCHA maintained a Remedial Action Scheme (RAS) for the loss of this 230kV transmission line that would have tripped generation to relieve loading on a separate 230 kV line. However, based on the ambient temperature, this 230kV transmission line remained within its prorated ambient temperature rating and no RAS actions were required. BCHA also quickly addressed the Sustained Outage in this instance. Nevertheless, BCHA implemented ineffective internal controls to prevent or sufficiently compensate for this violation.
Thus, demonstrating the beginning of systemic problems in BCHA's FAC-003 program resulting in programmatic failure. For these reasons, WECC concluded this Alleged Violation posed a serious and substantial risk to the reliability of the BES.

NERC Reliability Standard FAC-003-4 R2.1, June 4, 2019 at 5 PM
WECC Violation #BCUC2020000724

Facts and Circumstances:
On June 4, 2019, at approximately 5:00 PM, BCHA had a vegetation encroachment into the MVCD from a Cottonwood Coppice tree on a different set of parallel 230 kV transmission lines than the May 22, 2019 violation. However, the affected parallel 230 kV transmission lines were connected to the same substation associated with the May 22, 2019 Sustained Outage. In this instance, the vegetation encroachment did not cause a Sustained Outage; however, the local fire department responded to a report from the public that a tree was on fire and they contacted BCHA. The Cottonwood Coppice tree was removed by BCHA the same night under live line methods. The violation began when the vegetation encroachment occurred on June 4, 2019, at 5:00 PM and ended the same day when BCHA removed the tree, for a total of one day.

Root Cause Analysis:
The root cause of this violation was ineffective corrective action for a previously identified problem. Following the May 22, 2019 Sustained Outage, BCHA did not perform an effective extent of condition review across its transmission system to determine if other vegetation encroachments into the MVCD had existed in its system at that time. In addition, a contributing cause was attributed to BCHA's inadequate systematic examination of vegetation conditions that were likely to pose a hazard to the transmission lines prior to the next planned maintenance or inspection. Specifically, as demonstrated by this violation, BCHA did not understand the vegetation growth rates and patterns for this Cottonwood Coppice tree. Though BCHA had a well-documented TVMP, BCHA did not provide adequate training for its staff to ensure that systematic measurement of vegetation and supervisory methods of the inspections were executed properly. Inexperienced field personnel partially implemented the procedures in the TVMP and underestimated potential line sag and potential growth rate of vegetation. This instance of noncompliance with R2 demonstrated that the basis for the root cause of BCHA's systemic and programmatic failure with FAC-003 is its failure to complete adequate Vegetation Inspections of its applicable lines, as required by FAC-003-4 R6.

Reliability Risk Assessment:
In this instance, harm did occur when a fire resulted from BCHA failing to manage a Cottonwood Coppice tree to prevent an encroachment into the MVCD of its 230 kV transmission line which was not either an element of an IROL, or an element of a Major WECC Transfer Path, observed in Real-time, absent a Sustained Outage, as required by FAC-003-4 R2.1.

Such failure could have resulted in a vegetation related outage and the loss of two 230 kV substations due to an absence of 230 kV transmission support. As compensation, the 230kV transmission line was not a WECC Major Transfer Path. BCHA implemented ineffective internal controls to prevent or sufficiently compensate for this instance. The remediation steps for the previous 2019 Sustained Outage and vegetation encroachment (associated with WECC Violation # BCUC2019000681) were not effective in preventing the encroachment and resulting fire. Thus, demonstrating another example of systemic problems in BCHA's FAC-003 program resulting in programmatic failure. For these reasons, WECC concluded this Alleged Violation posed a serious and substantial risk to the reliability of the BES.

NERC Reliability Standard FAC-003-4 R2.4, June 4, 2019 at 8:51 PM
WECC Violation #BCUC2020000725

Facts and Circumstances:
On June 4, 2019, at 8:51 PM, BCHA experienced a vegetation related Sustained Outage caused by a Cherry tree encroachment into the MVCD on the same parallel 230 kV transmission lines and one span away from the Sustained Outage on May 22, 2019, and on the same day as the June 4, 2019 vegetation encroachment. The Sustained Outage ended at 8:54 PM, lasting a total of three minutes. The violation began on June 4, 2019 when the encroachment occurred and ended when BCHA removed the Cherry tree with the burnt top on June 6, 2019, which was determined to be the cause of the Sustained Outage, for a total of two days.

Root Cause Analysis:
The root cause of this violation was BCHA's incomplete annual vegetation work plan, as required by FAC-003-4 R7. On June 19, 2018 vegetation issues were identified for the line span of the parallel 230 kV transmission lines affected by this instance and the vegetation work that was included in a fiscal year 2019 work plan covering the period April 1, 2018- March 31, 2019. The remediation vegetation work should have been completed by March 31, 2019. In addition, a contributing cause was attributed to BCHA's inadequate systematic examination of vegetation conditions that were likely to pose a hazard to the transmission lines prior to the next planned maintenance or inspection. Specifically, as demonstrated by the violation, BCHA did not understand the vegetation growth rates and patterns for this Cherry tree. Though BCHA had a well-documented TVMP, BCHA did not provide adequate training for its staff to ensure that systematic measurement of vegetation and supervisory methods of the inspections were executed properly. Inexperienced field personnel partially implemented the procedures in the TVMP and underestimated potential line sag and potential growth rate of vegetation. This instance of noncompliance with R2 demonstrated that the

basis for the root cause of BCHA's systemic and programmatic failure with FAC-003 was its failure to complete adequate Vegetation Inspections of its applicable lines, as required by FAC-003-4 R6.

Reliability Risk Assessment:
In this instance, harm did occur when BCHA failed to manage vegetation to prevent an encroachment of a Cherry tree into the MVCD of its applicable 230 kV transmission line which was not either an element of an IROL, or an element of a Major WECC Transfer Path that caused a vegetation-related Sustained Outage, as required by FAC-003-4 R2.4.

Such failure resulted in a Sustained Outage on a 230 kV transmission line that lasted for three minutes and could have caused the loss of one or more BES circuits or the loss of generation. The transmission line did have a parallel 230 kV transmission line however, the parallel line was out of service during the outage which could have resulted in cascading or widespread outages.

As compensation, the 230kV transmission line was not a WECC Major Transfer Path. BCHA also quickly addressed the Sustained Outage in this instance. Nevertheless, BCHA implemented ineffective internal controls to prevent or sufficiently compensate for this violation. The remediation steps for the previous 2019 Sustained Outages and vegetation encroachments (associated with WECC Violation # BCUC2019000681 and BCUC2020000724) were not effective in preventing the encroachment and Sustained Outage. Thus, demonstrating another example of systemic problems in BCHA's FAC-003 program resulting in programmatic failure. For these reasons, WECC concluded this Alleged Violation posed a serious and substantial risk to the reliability of the BES.

NERC Reliability Standard FAC-003-4 R4, June 5, 2019
WECC Violation #BCUC2020000727

Facts and Circumstances:
The WECC Compliance Investigation found that on June 4, 2019 at 8:51 PM BCHA experienced a vegetation related Sustained Outage (BCUC #2020000725) caused by a Cherry tree encroachment into the MVCD on the same parallel 230 kV transmission lines and one span away from the Sustained Outage on May 22, 2019. A control room operations window entry was made at 8:51 PM, which indicated the outage that ended at 8:54 PM. Then, on June 5, 2019, a BCHA TVMP employee was patrolling the transmission line associated with the Sustained Outages on May 22, 2019 and June 4, 2019 and was examining for vegetation suspected of causing the Sustained Outage from June 4, 2019. At approximately 5:00 PM, the TVMP employee located a group of trees between two structures that showed evidence of a high voltage flashover. The TVMP employee measured the distance between the top of the tallest tree to the nearest energized conductor to be 0.8 meters. The

BCHA MVCD for a 230 kV transmission line was 1.3 meters; however, the TVMP employee's documented review confirmed the remaining vegetation was still 0.8 meters away from the conductor, thus within the MVCD. The vegetation associated with the June 4, 2019 Sustained Outage was still encroaching the MVCD at the time it was observed, and the transmission line was operating within its System Operating Limits (SOL); thus, the TVMP employee confirmed the existence of a vegetation condition that was likely to cause a Fault at any moment.

The TVMP employee correctly followed the BCHA Vegetation Risk Confirmation procedure and contacted the Line Manager to schedule a line outage the following day to safely remove the vegetation. The Line Manager contacted the Control Center by phone on June 5, at 6:35 PM to request a "forced outage," but does not clearly communicate the urgency of the vegetation condition that was still encroaching into the MVCD. During the call, the Control Center confirmed that it will order a "forced outage" for the next day, June 6 to enable a line crew to remove the vegetation. From the time of the vegetation-related outage on June 4 to the "forced outage" on June 6, BCHA did not communicate the urgency of the vegetation condition, resulting in a time delay that was part of BCHA's procedures. This violation began on June 4, 2019, when BCHA did not inform its Control Center Operator of the vegetation condition posing imminent risk without an intentional time delay and ended on June 6, 2019 when the transmission line was placed in a "forced outage" and the tree was removed , for a total of two days.

Root Cause Analysis:
The root cause of the violation was attributed to poor procedural design and ineffective preventative controls in BCHA's procedure. The procedure stated that the observer must contact the appropriate Line Manager and relay the information, then the Line Manager is responsible for notifying the Control Center System Operator (SO) of a confirmed existence of a vegetation condition likely to cause a Fault at any moment. However, this series of communications introduces an intentional delay and increases the likelihood that original description of the confirmation of existence of a vegetation condition likely to cause a Fault at any moment will not reach the audience for which it was originally intended.

Reliability Risk Assessment:
In this instance, BCHA, without any intentional time delay, failed to effectively notify the Control Center holding switching authority for the affected 230 kV transmission line when BCHA confirmed the existence of a vegetation condition that was likely to cause a Fault at any moment, as required by FAC-003-4 R4.

Such failure could have resulted in a RAS to trip on affected 230 kV transmission line that could have impacted another 230 kV transmission line, which could have then tripped generation to relieve loading on the affected 230 kV transmission line. However, as compensation, if the RAS tripped, SO intervention could have mitigated post-contingency overloading. In this instance, the ambient temperature of the 230 kV transmission line remained in its prorated temperature rating and no RAS actions were required.

BCHA did not implement effective internal controls to prevent or sufficiently compensate for this violation thus, demonstrating another example of systemic problems with BCHA's FAC-003 program resulting in a programmatic failure. For these reasons, WECC concluded this Alleged Violation posed a serious and substantial risk to the reliability of the BES.

NERC Reliability Standard FAC-003-4 R7
WECC Violation #BCUC2020000729

Facts and Circumstances:
The WECC Compliance Investigation found that BCHA did not complete the necessary actions in its annual work plan to effectively manage vegetation issues identified in its Vegetation Inspections. On June 19, 2018 vegetation issues were identified via aerial inspection on the 230 kV line and span that experience the vegetation encroachment that led to the Sustained Outage on June 4, 2019 at 8:51 PM. The inspector noted that the "work type" associated with the vegetation issue was a "priority" and close to the limit of approach in the span associated with the June 4, 2019 Sustained Outage. The annual vegetation work plan included in a fiscal year 2019 work plan covering the period April 1, 2018- March 31, 2019. The remediation vegetation work on the 230 kV transmission line should have been completed by March 31, 2019. This issue began on April 1, 2019, when BCHA was required to complete 100% of its annual vegetation work plan of applicable lines and ended June 6, 2019 when the tree responsible for the June 5, 2019 8:51 PM (WECC Violations #BCUC2020000725) Sustained Outage was removed for a total of 67 days.

Root Cause Analysis:
The root cause of the violation was attributed to BCHA's failures with its Vegetation Inspection program, specifically, inadequate systematic examination of vegetation conditions that were likely to pose a hazard to the transmission lines prior to the next planned maintenance or inspection as demonstrated by the incomplete vegetation work plan.

Reliability Risk Assessment:
In this instance, harm did occur when BCHA failed to complete 100% of its annual vegetation work plan of applicable lines to ensure no vegetation encroachments occurred within the MVCD, as required by FAC-003-4 R7.

Such failure resulted in a Sustained Outage on a 230 kV transmission line on June 5, 2019. The 230kV transmission line was not a WECC Major Transfer Path and the transmission line did have a parallel 230 kV transmission line, however the parallel line was out of service during the outage, thus increasing the risk of cascading or widespread outages.

As compensation, the 230kV transmission line was not a WECC Major Transfer Path. BCHA maintained a Remedial Action Scheme (RAS) for the loss of this 230kV transmission line that would have tripped generation to relieve loading on a separate 230 kV line. However, based on the ambient temperature, this 230kV transmission line remained within its prorated ambient temperature rating and no RAS actions were required.

BCHA did not implement effective controls to prevent or sufficiently compensate for this violation. Thus, demonstrating another example of systemic problems in BCHA's FAC-003 program resulting in programmatic failure. For these reasons, WECC concluded this Alleged Violation posed a serious and substantial risk to the reliability of the BES

NERC Reliability Standard FAC-003-4 R2.1, June 7, 2019 at 12:00 PM
WECC Violation #BCUC2020000726

Facts and Circumstances:
On June 7, 2019, at approximately 12:00 PM, BCHA experienced a vegetation encroachment into the MVCD by a Willow tree on the same 230 kV transmission lines as the May 22, 2019 and June 4, 2019 encroachment and Sustained Outages. BCHA received a report that there was a small fire in the ROW of the 230 kV transmission line. BCHA quickly de-rated the 230 kV transmission line and found the Willow tree with a burnt top within the MVCD which was determined to be the cause of the fire. The Willow tree with a burnt top was removed at 5 PM the same day. The violation began on June 7, 2019, when the vegetation encroached on a 230 kV transmission line and ended on June 7, 2019, when the Willow tree was removed, for a total of one day.

Root Cause Analysis:
The root cause of this violation was ineffective corrective action for a previously identified problem. Following the May 22, 2019 and June 4, 2019 encroachments and Sustained Outages, BCHA did not

perform an extent of condition review across its transmission system to determine if other vegetation encroachments into the MVCD had existed at that time. In addition, a contributing cause was attributed to BCHA's inadequate systematic examination of vegetation conditions that were likely to pose a hazard to the transmission lines prior to the next planned maintenance or inspection. Specifically, as demonstrated by the violation, BCHA did not understand the vegetation growth rates and patterns for this Willow tree. Though BCHA had a well-documented TVMP, BCHA did not provide adequate training for its staff to ensure that systematic measurement of vegetation and supervisory methods of the inspections were executed properly. Inexperienced field personnel partially implemented the procedures in the TVMP and underestimated potential line sag and potential growth rate of vegetation. This instance of noncompliance with R2 demonstrated that the basis for the root cause of BCHA's systemic and programmatic failure with FAC-003 is its failure to complete adequate Vegetation Inspections of its applicable lines, as required by FAC-003-4 R6.

Reliability Risk Assessment:
In this instance, harm did occur when a fire resulted from BCHA failing to prevent the encroachment of a Willow tree into the MVCD of the affected 230 kV transmission line, which was not either an element of an IROL, or an element of a Major WECC Transfer Path, observed in Real-time, absent a Sustained Outage, as required by FAC-003-3 R2.1.

Such failure could have resulted in a vegetation related Sustained Outage and the loss of two 230 kV substations due to an absence of 230 kV transmission support. As compensation, no RAS actions were required, however had the ambient temperature been higher, the RAS would have shed load to keep the 230kV transmission line within its rating, thus decreasing the risk that cascading outages or loss of load would have occurred.

BCHA did not implement effective controls to prevent or sufficiently compensate for this violation. The remediation steps for the previous 2019 Sustained Outages and vegetation encroachments (associated with WECC Violation # BCUC2019000681, BCUC2020000724, and BCUC2020000725) were not effective in preventing the encroachment and resulting fire. Thus, demonstrating another example of systemic problems in BCHA's FAC-003 program resulting in programmatic failure. For these reasons, WECC concluded this Alleged Violation posed a serious and substantial risk to the reliability of the BES

NERC Reliability Standard FAC-003-4 R2.4, June 25, 2020
WECC Violation #BCUC2020000733

Facts and Circumstances:
On June 25, 2020, BCHA had two vegetation-related Sustained Outages on a 360 kV transmission line caused by a Douglas Fir tree. These violations affected four spans of a 360 kV transmission line located at a dual circuit corridor with another 360 KV transmission line. The four spans were directly located between a generating station and a terminal substation. First, at 1:50 PM, an arcing Douglas Fir tree caused a Sustained Outage and tripped the associated generating station generating 202 MW at the time, though its capacity was 240 MW. BCHA did not respond or take corrective action because it incorrectly assumed that the tree had burned clear and was no longer within the MVCD, and at 2:30 PM BCHA re-energized the 360kV transmission line. At 2:58 PM, the 360 kV transmission line tripped again, resulting in a second Sustained Outage due to the Douglas Fir contacting the line. BCHA left the line out of service until June 26, 2020 when at 2:35 PM BCHA removed the Douglas Fir and returned the line to service. This violation began on June 25, 2020, when vegetation encroached on a 360kV transmission line and ended on June 26, 2020, when BCHA removed the Douglas Fir tree, for a total of two days.

Root Cause Analysis:
The root cause was attributed to lack of corrective action for a Douglas Fir tree that should have been removed but had been incorrectly measured during a previous Vegetation Inspection conducted on November 18, 2019. BCHA's systematic examination of vegetation conditions that were likely to pose a hazard to the transmission lines prior to the next planned maintenance or inspection were inadequate. Specifically, as demonstrated by the violation, BCHA did not understand the vegetation growth rates and patterns for this Douglas Fir tree. Though BCHA had a well-documented TVMP, BCHA did not provide adequate training for its staff to ensure that systematic measurement of vegetation and supervisory methods of the inspections were executed properly. Inexperienced field personnel partially implemented the procedures in the TVMP and underestimated potential line sag and potential growth rate of vegetation. This instance of noncompliance with R2 demonstrated that the basis for the root cause of BCHA's systemic and programmatic failure with FAC-003 is its failure to complete adequate Vegetation Inspections of its applicable lines, as required by FAC-003-4 R6.

Reliability Risk Assessment:
In this instance, harm did occur when BCHA failed to manage a Douglas Fir tree to prevent encroachments into the MVCD of the affected 360kV transmission line, which was not either an element of an IROL, or an element of a Major WECC Transfer Path, that caused two vegetation-related Sustained Outages, as required by FAC-003-4 R2.4.

Such failure resulted in two Sustained Outages on a 360 kV transmission line that lasted for 48 minutes and 23 ½ hours, respectively, and could have caused the loss of one or more BES circuits. In addition, the first Sustained Outage resulted in a loss of 202 MW of generation when the generating unit tripped. The second Sustained Outage did not cause the loss of load but, could have resulted in low voltage because of the loss of generation which provided voltage support.

BCHA implemented ineffective internal controls to prevent or sufficiently compensate for this violation. The remediation steps for the 2019 Sustained Outages and vegetation encroachments (associated with WECC Violation # BCUC2019000681, BCUC2020000724, BCUC2020000725, and BCUC2020000726) were not effective in preventing the two encroachments and Sustained Outages. Thus, demonstrating another example of systemic problems in BCHA's FAC-003 program resulting in programmatic failure. For these reasons, WECC concluded this Alleged Violation posed a serious and substantial risk to the reliability of the BES.

NERC Reliability Standard FAC-003-4 R2.4 July 28, 2020- July 29, 2020
WECC Violation #BCUC2020000735

Facts and Circumstances:
On July 28, 2020 BCHA had a vegetation-related Sustained Outage on a 500 kV circuit at a three-circuit transmission corridor Right of Way (ROW) that included two 500 kV circuits and one 230 kV circuit that were part of a large substation. The 500 kV transmission line tripped at 3:25 PM due to a Black Cottonwood tree encroachment into the MVCD resulting in the Sustained Outage that ended at 3:31 PM, for a total of six minutes. BCHA removed the Black Cottonwood tree responsible for the Sustained Outage at 7:45 PM on July 29, 2020.

BCHA's Vegetation Inspections conducted May 19, 2019 identified the associated area for corrective actions to be completed in 2020, but the contractor who performed the inspection was only qualified for trimming (slashing) work and not tree removal. Furthermore, the contractor did not identify that a certified tree faller was needed in the area and had incorrectly indicated that the work was completed. When BCHA completed an audit of the area identified as needing corrective action, the Vegetation Coordinator was not able to access the specific location where the Sustained Outage later occurred on July 28, 2020, due to flooding and concerns that access would have impacted the cultivated field. Then on July 28, 2020, during Vegetation Inspections implemented after the June 25, 2020 encroachments and Sustained Outages, another helicopter patrol did not identify this area as having an imminent threat of encroachment. This violation began on July 28, 2020 when a tree encroached and ended on July 29, 2020, when BCHA removed the tree, for a total of one day.

Root Cause Analysis:
The root cause was attributed to lack of corrective action for a Black Cottonwood tree that should have been removed when it was identified as needing corrective action by a previous Vegetation Inspection conducted in May 19, 2019. BCHA's systematic examination of vegetation conditions that were likely to pose a hazard to the transmission lines prior to the next planned maintenance or inspection were inadequate. Specifically, as demonstrated by the violation, BCHA did not understand the vegetation growth rates and patterns for this Black Cottonwood tree. Though BCHA had a well-documented TVMP, BCHA did not provide adequate training for its staff to ensure that systematic measurement of vegetation and supervisory methods of the inspections were executed properly. Inexperienced field personnel partially implemented the procedures in the TVMP and underestimated potential line sag and potential growth rate of vegetation. This instance of noncompliance with R2 demonstrated that the basis for the root cause of BCHA's systemic and programmatic failure with FAC-003 is its failure to complete adequate Vegetation Inspections of its applicable lines, as required by FAC-003-4 R6.

Reliability Risk Assessment:
In this instance, harm did occur when BCHA failed to prevent a Black Cottonwood tree from encroachment into the MVCD of its applicable 500 kV transmission line which was not either an element of an IROL, or an element of a Major WECC Transfer Path, that caused a six-minute vegetation-related Sustained Outage, as required by FAC-003-4 R2.2.

Such failure could have resulted in the loss of one or more BES circuits or the loss of generation. Additionally, the failure could have resulted in in the separation and islanding of over 2500 MW of generation, the loss of 58 MW of Independent Power Producer (IPP) generation, and the loss of 25 MW of load which could have caused BCHA to declare an Energy Emergency Alert along with the possibility of post-contingency voltage issues if the parallel 500 kV line been in maintenance or forced out of service.

BCHA implemented ineffective internal controls to prevent or sufficiently compensate for this violation. The remediation steps for the 2019 and 2020 Sustained Outages and encroachments (associated with WECC Violation # BCUC2019000681, BCUC2020000724, BCUC2020000725, BCUC2020000726, and BCUC2020000733) were not effective in preventing this encroachment and Sustained Outage. Thus, demonstrating another example of systemic problems in BCHA's FAC-003 program resulting in programmatic failure. For these reasons, WECC concluded this Alleged Violation posed a serious and substantial risk to the reliability of the BES.

NERC Reliability Standard FAC-003-4 R.2.4 July 29, 2020
WECC Violation #BCUC2020000734

Facts and Circumstances:
On July 29, 2020, at 1:40 PM, a 287 kV transmission line experienced a Sustained Outage due to a Red Alder tree encroaching into the MVCD. The tree was identified, and the line remained out of service until the tree could be removed on July 30, 2020, at 2:43 PM. The transmission line was a radial feed and located at a generation connection. The violation began on July 29, 2020, when the Red Alder tree encroachment into the MVCD led to a Sustained Outage and ended on July 30, 2020, when the tree at issue was removed, for a total of two days.

Root Cause Analysis:
The root cause of the violation was attributed to BCHA's inadequate systematic examination of vegetation conditions that were likely to pose a hazard to the transmission lines prior to the next planned maintenance or inspection. In this instance, BCHA only implemented aerial patrols, which had limited BCHA's ability to identify grow-ins under the lines. The aerial patrol flew directly over the lines, instead of Vegetation inspections that evaluate vegetation from the ground, which caused BCHA not to be able to properly evaluate the depth and distance of the vegetation from the MVCD. Furthermore, the area was a riparian zone and this specific tree had been trimmed multiple times. The trimming should have occurred every three years in the area, but the treatment had not occurred for this tree in eight years. This instance of noncompliance with R2 demonstrated that the basis for the root cause of BCHA's systemic and programmatic failure with FAC-003 is its failure to complete adequate Vegetation Inspections of its applicable lines, as required by FAC-003-4 R6.

Reliability Risk Assessment:
In this instance, harm occurred when BCHA failed to prevent a Red Adler tree from an encroachment into the MVCD of a Red Adler tree of the affected 287 kV transmission line, which was not either an element of an IROL, or an element of a Major WECC Transfer Path, that caused a vegetation-related Sustained Outage, as required by FAC-003-4 R2.4. The 287 kV transmission line provided for a local load of up to 50 MW, had a connection for 53 MW of generation and eight MW of generation for an Independent Power Producer.

Such failure could have resulted in the loss of 50 MW of generation due to the radial feed structure of the 287 kV transmission line to a nearby township, and the ability to use generation resources of 61 MW back to a 500 kV tie substation. However, as compensation, the generation normally used for peak load was online when the affected 287 kV transmission line into the local township tripped.

BCHA implemented ineffective internal controls to prevent or sufficiently compensate for this instance. The remediation steps for the 2019 and 2020 Sustained Outages and vegetation encroachments (associated with WECC Violation # BCUC2019000681, BCUC2020000724, BCUC2020000725, BCUC2020000726, BCUC2020000733 and BCUC2020000735) were not effective in preventing this Sustained Outage. Thus, demonstrating another example of systemic problems in BCHA's FAC-003 program resulting in programmatic failure. For these reasons, WECC concluded this Alleged Violation posed a serious risk to the reliability of the BES.

NERC Reliability Standard FAC-003-3 R6
WECC Violation # BCUC2020000728

Facts and Circumstances:
Specifically, the WECC Compliance Investigation found that BCHA did not perform adequate Vegetation Inspections from September 28, 2017, and the violation is ongoing. The inspections did not account for the movement of applicable transmission line conductors under their Rating and all Rated Electrical Operating Conditions and/or the Inter-relationships between vegetation growth rates and vegetation control methods. Thus, BCHA did not adequately perform Vegetation Inspections to prevent encroachments into the MVCD that resulted in Sustained Outages and loss of load.

Specifically, during the helicopter patrol on September 28, 2017 the BCHA employee who performed the patrol did not identify fast-growing vegetation on the respective 203 kV transmission lines that caused the Sustained Outages on May 22, 2019 and June 4, 2019 at 8:51 PM, and the encroachment on June 7, 2019 at 12:00 PM. A subsequent inspection on this transmission line on March 12, 2018 also failed to note the fast-growing vegetation on the same 230 kV transmission line. During the helicopter inspection on June 19, 2018, the inspectors did not identify the fast-growing vegetation, but they did note an opportunity for work for trees that appeared to be located on the edge or close to the ROW. The notes indicated that the vegetation was close to the limit of approach (1.5 meters) which indicated that the inspector did identify vegetation underneath the conductors. However, the inspection did not result in removing the vegetation that caused the June 7, 2019 encroachment. The ground patrol inspections from December 6, 2018 to March 22, 2019 showed that BCHA did not maintain inspection records for the area associated with the June 7, 2019 encroachment. During this period, the Vegetation Inspections removed a tree, but not in the grove of trees that caused the June 4, 2019 8:51 PM Sustained Outage.

Regarding the 230 kV transmission line associated with the June 4, 2019, 5:00 PM encroachment; BCHA performed ground inspections from January 17, 2019 through March 8, 2019. On January 17,

2019, the ground patrol identified and removed vegetation within the ROW located directly adjacent to an energized conductor that required corrective actions. At the time, the ground patrol determined that the clearance distance appeared to be sufficient, however the patrol did not account for the movement of applicable transmission line conductors under their Rating and all Rated Electrical Operating Conditions and four months later a tree encroached onto this transmission line.

On November 18, 2019 during a ground patrol vegetation inspection of the 360 kV transmission line associated with the June 25, 2020 Sustained Outage, the vegetation was not correctly measured and later encroached into the MVCD causing a Sustained Outage on June 25, 2020.

In May 2019, BCHA's Vegetation Inspections identified the area associated with the July 28, 2020 Sustained Outage on a 500 kV transmission line for treatment to be completed in 2020, but the contractor who performed the inspection was only qualified for trimming (slashing) work and not tree removal. Furthermore, the contractor did not identify that a certified tree faller was needed in the area and had incorrectly indicated that the work was completed. When BCHA completed an audit of the area, the Vegetation Coordinator was not able to access the specific location where the July 28, 2020 Sustained Outage later occurred due to flooding and concerns that access would have impacted the cultivated field. Then on July 28, 2020, during Vegetation Inspections implemented after the June 25, 2020 Sustained Outages, another helicopter patrol did not identify this area as having an imminent threat of encroachment.

Finally, on June 23, 2020 a helicopter patrol inspection did not identify the vegetation as needing imminent treatment on the 287 kV transmission line which later led to the July 29, 2020 Sustained Outage.

Thus, numerous inspections via both helicopter and ground patrols did not identify fast-growing vegetation that led to the Sustained Outages and vegetation encroachments in 2019 and 2020. Since BCHA did not perform an extent of condition review of its entire system, BCUC issued a Remedial Action Directive pertaining to FAC-003-4 R2, BCUC Confidential Order R-1-21. Therefore, this violation of R6 began on September 28, 2017 when BCHA did not effectively perform its Vegetation Inspections on 100% of its applicable transmission lines and is ongoing.

Root Cause Analysis:
The root cause of this violation was BCHA's inadequate training for its staff and contactors to ensure that systematic measurement and supervisory methods were executed properly. Furthermore, BCHA's management did not provide the necessary resources to its Vegetation Inspection program to ensure it was a well-functioning program.

Reliability Risk Assessment:
In this instance, BCHA failed to perform a Vegetation Inspection of its applicable transmission lines (measured in units of choice - circuit, pole line, line miles or kilometers, etc.) at least once per calendar year and with no more than 18 calendar months between inspections on the same ROW, as required by FAC-003-3 R6.

Such failure did cause harm to occur when BCHA experienced seven vegetation-related Sustained Outages and vegetation encroachments into the MVCD. Such failure could have caused cascading outages and loss of load or damage of BES equipment. BCHA implemented weak controls to prevent or sufficiently compensate for this violation. For these reasons, WECC concluded this Alleged Violation posed a serious and substantial risk to the reliability of the BES.

MITIGATION:
NERC Reliability Standard FAC-003-4 R2.4 WECC Violation #BCUC2019000681
NERC Reliability Standard FAC-003-4 R2.1 WECC Violation #BCUC2020000724
NERC Reliability Standard FAC-003-4 R2.4 WECC Violation #BCUC2020000725
NERC Reliability Standard FAC-003-4 R2.1 WECC Violation #BCUC2020000726

BCHA completed initial air patrols of the transmission line associated with the May 22, 2019, June 4, 2019 and June 7, 2019 instances by June 10, 2019 and completed span-by-span ground patrols of the affected lines by August 15, 2019. BCHA implemented corrective actions on these transmission lines and an additional 38 transmission lines by September 30, 2019.

BCHA performed a final Quality Assurance Vegetation Inspection after all identified corrective actions had been implemented on September 4, 2019. However, these additional patrols were not sufficient to detect vegetation issues in real time, nor prevent the 2019 and 2020 encroachments and Sustained Outages. In addition, the additional patrols did not include a system-wide evaluation of existing vegetation conditions.

BCHA is currently remediating this issue, per a Remedial Action Directive pertaining to FAC-003-4 R2, BCUC Confidential Order R-1-21, which required BCHA to perform an extent of condition review of its most high-risk transmission lines. In addition, through mitigation assistance, WECC is working with BCHA to create a comprehensive mitigation plan for R2 to address vegetation conditions throughout its entire system.

NERC Reliability Standard FAC-003-4 R4 WECC Violation # BCUC2020000727
Through mitigation assistance, WECC is working with BCHA to create a comprehensive mitigation plan for R4. BCHA is performing an extent of condition review, will be mitigating the root cause,

and working to prevent future inadequate systematic examinations of vegetation conditions of its applicable transmission lines.

NERC Reliability Standard FAC-003-4 R7 WECC Violation # BCUC2020000729
Through mitigation assistance, WECC is working with BCHA to create a comprehensive mitigation plan for R7. BCHA is performing an extent of condition review, will be mitigating the root cause, and working to prevent future inadequate systematic examinations of vegetation conditions of its applicable transmission lines.

NERC Reliability Standard FAC-003-4 R2.4 WECC Violation #BCUC2020000733
NERC Reliability Standard FAC-003-4 R2.4 WECC Violation #BCUC2020000735
NERC Reliability Standard FAC-003-4 R.2.4 WECC Violation #BCUC2020000734

The mitigation steps for the 2019 Sustained Outages and vegetation encroachments (associated with WECC Violation #BCUC2019000681, BCUC2020000724, BCUC2020000725, and BCUC2020000726) were not effective in preventing the vegetation-related encroachments and Sustained Outages that occurred on June 25, 2020, July 28, 2020, and July 29th, 2020. As a result of the June 25, 2020 Sustained Outages BCHA performed additional Vegetation Inspections via aerial and ground patrols across its system and identified 233 sites where vegetation was identified to be removed to avoid encroachments into the MVCD. However, these inspections were not effective in preventing the subsequent vegetation related encroachments and Sustained Outages in 2020.

BCHA is currently remediating this issue, per a Remedial Action Directive pertaining to FAC-003-4 R2, BCUC Confidential Order R-1-21, which required BCHA to perform an extent of condition review of its most high-risk transmission lines. In addition, through mitigation assistance, WECC is working with BCHA to create a comprehensive mitigation plan for R2 to address vegetation conditions throughout its entire system.

NERC Reliability Standard FAC-003-3 R6 WECC Violation # BCUC2020000728
Through mitigation assistance, WECC is working with BCHA to create a comprehensive mitigation plan for R6. BCHA is performing an extent of condition review, will be mitigating the root cause, and working to prevent future inadequate systematic examinations of vegetation conditions of its applicable transmission lines.

Relevant Information:

By Commission Order R-34-15, the BCUC, as Compliance Monitoring Authority in British Columbia (BC), approved that the NERC Violation Risk Factor (VRF) and Violation Severity Level (VSL)

matrices that accompany the Reliability Standards adopted in BC will be used as Compliance Provisions in the BC MRS Program to consider the base penalty range for Alleged Violations. The following information is provided as useful context regarding how WECC uses the facts and circumstances of the Alleged Violation, the entity's behavior and other similar factors to determine a penalty recommendation to the BCUC.

WECC considers various factors in its review of Possible and Alleged Violations. These factors include, but are not limited to: (1) Violation Risk Factor; (2) Violation Severity Level; (3) risk to the reliability of the Bulk Electric System, including the seriousness of the violation; (4) the violation's duration; (5) the Registered Entity's compliance history; (6) the Registered Entity's self-reports and voluntary corrective action; (7) the degree and quality of cooperation by the Registered Entity in an audit or investigation process, and in any remedial actions required; (8) the quality of the Registered Entity's compliance program; (9) any attempt by the Registered Entity to conceal the violation or any related information; (10) whether the violation was intentional; and (11) any other relevant information or extenuating circumstances.

Reliability Impact and Severity Evaluation:
Regarding the two failures of FAC-003-4 R2.1, five failures of FAC-003-4 R2.4, failure of FAC-003-4 R4, failure of FAC-003-3 R6, and failure of FAC-003-4 R7, WECC concluded these 10 Alleged Violations posed a serious and substantial risk to the reliability of the BES. BCHA had a programmatic failure of its FAC-003 vegetation management program that was demonstrated by the seven vegetation-related encroachments and/or Sustained Outages, its failure to complete adequate Vegetation Inspections of its applicable lines, its failure to complete its 2019 annual vegetation work plan, and its failure to notify its control center of a vegetation condition that was likely to cause a fault. BCHA is currently working with WECC, pursuant to a Remedial Action Directive pertaining to FAC-003-4 R2, BCUC Confidential Order R-1-21, which required BCHA to perform an extent of condition review on all applicable transmission lines.

Proposed Penalty:
Upon applying the relevant BC Penalty Matrix adopted by the BCUC to the facts and circumstances of the Alleged Violations described herein, WECC informs BCHA that the following base penalty ranges and proposed penalty amounts represent the seriousness of the violations. For each R2 violation, the proposed penalty amount is higher than the BC base penalty range because harm occurred during each instance. Additionally, the proposed penalty amount for the R6 and R7 violations is higher than the BC base penalty range because these three violations are the root cause of the seven R2 violations, and the proposed penalty amount for the R4 violation is higher than the BC base penalty range due to the contribution to the overall programmatic failure.

For additional context, WECC also considers the NERC Sanction Guidelines for reasonableness when assessing proposed penalties. Upon applying the relevant NERC Sanction Guidelines and taking into consideration the facts and circumstances of the Alleged Violations described herein, if these serious Alleged Violations were assessed in the United States, with all things being equal, WECC informs BCHA that the following proposed penalty amounts represents the seriousness of the violation. All amounts listed are in US dollars.

FAC-003-4 R2.4 BCUC2019000681
BCUC Base Penalty Range: $20,000- $1,000,000
BCUC Proposed Penalty Amount: $468,000
NERC Proposed Penalty Amount: $691,200

FAC-003-4 R2.1 BCUC2020000724
BCUC Base Penalty Range: $12,000-$625,000
BCUC Proposed Penalty Amount: $299,520
NERC Proposed Penalty Amount: $368,640

FAC-003-4 R2.4 BCUC2020000725
BCUC Base Penalty Range: $20,000- $1,000,000
BCUC Proposed Penalty Amount: $499,200
NERC Proposed Penalty Amount: $614,400

FAC-003-4 R2.1 BCUC2020000726
BCUC Base Penalty Range: $12,000-$625,000
BCUC Proposed Penalty Amount: $299,520
NERC Proposed Penalty Amount: $368,640

FAC-003-4 R4 BCUC2020000727
BCUC Base Penalty Range: $6,000-$200,000
BCUC Proposed Penalty Amount: $168,480
NERC Proposed Penalty Amount: $207,360

FAC-003-4 R7 BCUC2020000729
BCUC Base Penalty Range: $2,000-$30,000
BCUC Proposed Penalty Amount: $30,000
NERC Proposed Penalty Amount: $56,160

FAC-003-4 R2.4 BCUC2020000733
BCUC Base Penalty Range: $20,000- $1,000,000
BCUC Proposed Penalty Amount: $499,200
NERC Proposed Penalty Amount: $614,400

FAC-003-4 R2.2 BCUC2020000735
BCUC Base Penalty Range: $20,000- $1,000,000
BCUC Proposed Penalty Amount: $499,200
NERC Proposed Penalty Amount: $614,400

FAC-003-4 R2.4 BCUC2020000734
BCUC Base Penalty Range: $20,000- $1,000,000
BCUC Proposed Penalty Amount: $499,200
NERC Proposed Penalty Amount: $614,400

FAC-003-3 R6 BCUC2020000728
BCUC Base Penalty Range: $10,000-$335,000
BCUC Proposed Penalty Amount: $297,000
NERC Proposed Penalty Amount: $518,400

Total BCUC Proposed Penalty Amount: $3,559,320
Total NERC Proposed Penalty Amount: $4,668,000

Additional Factors Affecting Penalty:
As a result of WECC's review of the facts and circumstances of the Alleged Violations, WECC offers the following information to BCHA and the BCUC as additional factors that affected the proposed penalty amounts:

- According to the January 13, 2021 Violation Risk Factor (VRF) matrix published by NERC, the seven FAC-003-4 R2 violations have a High VRF, the FAC-003-4 R4, FAC-003-3 R6 and FAC-003-4 R7 violations have a Medium VRF.

- According to the December 17, 2020 Violation Severity Level (VSL) matrix published by NERC, the two FAC-003-4 R2.1 violations have a High VSL because BCHA failed to manage vegetation to prevent encroachment into the MVCD of a line not identified as an element of an IROL or Major WECC transfer path and encroachment into the MVCD, as identified in the FAC-003-4-Table 2 and was observed in Real-time, absent a Sustained Outage.

- According to the December 17, 2020 VSL matrix published by NERC, the five FAC-003-4 R2.4 violations have a Severe VSL because BCHA failed to manage vegetation to prevent encroachment into the MVCD of a line not identified as an element of an IROL or Major WECC transfer path and a vegetation related Sustained Outage was caused by a grown-in.

- According to the December 17, 2020 VSL matrix published by NERC, the FAC-003-4 R4 violation had a High VSL because BCHA experienced a confirmed vegetation threat and notified the control center holding switching authority for that applicable line, but there was intentional delay in that notification. While WECC assessed a High VSL, WECC notes that a Severe VSL could also potentially be appropriate because even though BCHA did contact the control center to request an outage, it did not notify the control center of "a condition that is likely to cause a Fault at any moment."

- According to the December 17, 2020 VSL matrix published by NERC, the FAC-003-3 R6 violation has a Severe VSL because BCHA has an unconfirmed extent of condition, as evidenced by the findings of the RAD and BCHA's mitigation efforts, thus more than 15% of its applicable lines (measured in units of choice - circuit, pole line, line miles or kilometers, etc.) have annual vegetation work that is potentially uncompleted.

- According to the December 17, 2020 VSL matrix published by NERC, the FAC-003-4 R7 violation has a Lower VSL because BCHA failed to complete 5% or less of its annual vegetation work plan for its applicable lines (as finally modified).

- WECC considers the Violation Time Horizon (VTH) for FAC-003-4 R2 and FAC-003-4 R4 as "Real-time Operations" for the purpose of determining a reasonable timeframe for how long it should take an entity to remediate the violation: actions required within one hour or less to preserve the reliability of the BES. The VTH for FAC-003-4 R6 and FAC-003-4 R7 is "Operations Planning" for the purpose of determining a reasonable timeframe for how long it should take an entity to remediate the violation: actions required from day-ahead up to and including seasonal (48 hours to 90 days).

- WECC considered BCHA's size, location, and applicable factors when assessing the reliability impact and evaluating the seriousness of the violations.

- BCHA submitted Self-Reports on August 21, 2019, June 8, 2020, August 24, 2020, and September 14, 2020, addressing possible noncompliance with FAC-003-4 R2. During a

Compliance Investigation that concluded on May 15, 2020, WECC discovered additional instances of noncompliance with, FAC-003-4 R4, FAC-003-3 R6 and FAC-003-4 R7.

- BCHA does not have repeat violations of this Reliability Standard nor relevant negative compliance history. However, given the repeated failures to prevent and remediate vegetation encroachments and vegetation related Sustained Outages as the result of an ineffective Vegetation Management Program, these violations constitute a programmatic failure of BCHA's TVMP and FAC-003 program.

- There was no evidence of any attempt by BCHA to conceal or impede the investigation of the Alleged Violations.

- BCUC issued a Remedial Action Directive to BCHA and BCHA was cooperative.