

**Incident Summary #II-1714299-2024 (#46717) (FINAL) - Revised on January 23, 2025**

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|---------------------------|--|--|---|
| SUPPORTING INFORMATION    | Incident Date  | May 23, 2024   |   |
|                           | Location   | Powell River, BC   |   |
|                           | Regulated industry sector  | Electrical - High voltage electrical system (greater than 1000V)   |   |
|                           | Impact   | Qty injuries   | 2   |
|                           |  | Injury description   | Significant electrical burns to skin, unconsciousness, and internal injuries. |
|                           |  | Injury rating  | Major   |
|                           | Damage   | Damage description   | Partial power outage to a nearby business.                                    |
|                           |  | Damage rating  | Minor   |
|                           | Incident rating  | Major  |   |
| Incident overview         | Two (2) people gained unauthorized access to components inside a high-voltage energized electrical substation resulting in major injuries. |  |   |
| INVESTIGATION CONCLUSIONS | Site, system and components  | <p>The nine (9) year old, outdoor, ground-mounted substation was designed, built and installed as a complete four (4) sided weatherproof assembly to convert electricity from the electrical utility into different voltages for commercial use.</p> <p>It contained specialized equipment that allowed the electrical voltage to be transformed or switched with high voltage switchgear and a transformer in which the voltage was stepped up or down through various equipment.</p> <p>In this case, three phase power was routed from the overhead powerlines on the street underground through utility equipment, a switch.</p> <p>Then, the voltage goes into the utility owned side of the unit substation kiosk, which included the customer owned load break switch (fused), and a transformer to change the voltage from approximately 25 kilo volt/14.4 kilo volt (kV) to a consumer voltage of 600/347 volts.</p> <p>The switches and fuses are owned by the consumer not the utility, the point where the utility terminates to the customer equipment is typically known as the line of demarcation. Demarcation is the point at which the electrical system transfers ownership. Typically, the first point where the utility terminates to the consumer conductors.</p> <ul style="list-style-type: none"> <li>• Switchgear is a term used to describe electrical equipment used for the purpose of switching, controlling, and isolating electrical power systems.</li> <li>• Busbars (<a href="#">Image 6</a>) are produced in a variety of shapes, including flat strips, solid bars and rods, and are typically composed of copper, brass or aluminium as solid or hollow tubes. Material composition and cross-sectional size determine the maximum current it can safely carry. A busbar may be either supported on insulators or wrapped in insulation. They should be protected from accidental contact either by a metal earthed enclosure or by elevation out of normal reach.</li> </ul> <p>The electricity then travels through underground lines to the retailer breaker room in the mall where it was distributed for lighting, refrigeration, and other purposes.</p> |   |

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|                            | <p>Provisions are made for replacement of individual components in the substation by multiple access doors that should remain locked unless accessed by certified electrical professionals.</p> <p>The substation location was in a parking lot behind a shopping mall and is encircled by yellow cement barrier posts to avoid vehicle collisions but has no barriers to foot traffic (<a href="#">Image 1</a>). It is clearly visible from three (3) sides; however, the rear/fourth side is obstructed because it is facing a tree line that travels around the outer edge of the parking lot. This is the side the incident took place on.</p> <p>Maintenance requirements for unit substations are not prescriptive and best practice is typically 24 to 36 months according to National Electrical Testing Association (NETA) standards. There were no regulatory requirements to validate that locks were in place or if specific commercial or anti tampering locks are used and maintained between maintenance activities.</p> <p>The Canadian electrical code states that for metal enclosed switchgear, permanent, legible signs shall be installed on panels or doors that give access to energized parts, warning of the danger of opening them when parts are energized. There is no requirement for the size and style of the warning notices in the Canadian Electrical Code that should be used. Warnings are however mentioned to be conspicuously placed.</p>  |
| <p>Failure scenario(s)</p> | <p>Unit substations are meant to be locked to prohibit unauthorized persons from encountering dangerous voltages. The incident unit sub and transformer were secured only by doors with consumer pad locks. Access doors both controlled by the hydro utility and by property owners have this locking system for securement on this substation.</p> <p>The utility warnings are located on the rear where trees obstruct the view which is where the incident occurred.</p> <p>No labelling inside the doors indicating danger level and PPE requirements (no arc flash study done so not identified to be required at the time).</p> <p>The last scheduled maintenance for the unit was completed in 2022 and it is unclear at what point the lock was removed creating an opportunity for entry after that.</p> <p>Two (2) people gained access to the substation through an unsecured enclosure door (it is unknown how the door became unsecured.). One (1) individual came into contact with two points at the same time, an energized buss-conductor (<a href="#">Image 6</a>) made contact with one side of the body and the other being the frame of the unit-sub by a lower point on the same person's opposite side. This created an electrical pathway through their body and resulted in injury including contact point burns, and unconsciousness likely in the 14,000 Volt range.</p> <p>Scorch marks also occurred on the equipment and a blown fuse resulted in a power outage to a business nearby.</p> <p>A second person, acting with the first, also reported being closely behind and experienced a blowback by a force and was knocked over. They reported to police on the scene that their beard was scorched but reported no further injuries and received no medical assistance.</p> <p>As stated in interviews between RCMP officers, the injured individuals' self-identified as intoxicated that day, stated they also regularly loiter in that area which is often</p> |

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|                           | <p>used as a gathering place. These individuals stated that they did not fully understand how dangerous the equipment was.</p>   |
| <p>Facts and evidence</p> | <p><b>Fieldwork observations</b></p> <ul style="list-style-type: none"> <li>• The substation is not clearly marked as to what it is or contains from the front 3 side (<a href="#">Image 1</a>).</li> <li>• Signage on the front does not make it clear what type of equipment was within the enclosure (<a href="#">Image 3</a>). Signage on the utility portion (located at the back) was much clearer that the enclosure contained dangerous electrical equipment (<a href="#">Image 4</a>) compared to the consumer access door.</li> <li>• Sticker type warning labels on the consumer side access doors were observed as minimal, black and white on public facing sides, with some red on the same type of label placed on the rear facing (accessed side). Approximately 6x3 inches and faded in some areas (<a href="#">Image 3</a>). Graffiti and writing on doors creates a distraction visually for the impact of the warning labels that are there (<a href="#">Image 3</a> and <a href="#">Image 4</a>).</li> <li>• The rear side and access point for the incident was facing a line of trees which were trimmed previously due to loitering and drug use which was identified by managers at the mall as a hazard, but the trees were not fully removed due to concern by neighbouring residents on the other side concerned of unsightly views to parking lot (<a href="#">Image 2</a>).</li> <li>• Both access doors had been vandalized and tampered with. There were tool marks behind the padlocks and the lock for the utility side was bent (<a href="#">Image 7</a>).</li> <li>• The door, which was accessed, was covered in multicolor graffiti distracting from the small warnings labels (<a href="#">Image 6</a>).</li> <li>• there are pad locks on all outward facing doors which do not have specific regulation standards or tampering requirements but were observed to be typical consumer padlocks for securement and not marked with commercial use or special features.</li> <li>• The inside of the transformer had evidence of two contact or “scorch” marks from the electrical arcing (<a href="#">Image 6</a>).</li> </ul> <p><b>WITNESS STATEMENTS AND INFORMATION</b></p> <p>Utility Representative</p> <ul style="list-style-type: none"> <li>• When attending the incident to de energize the site, utility representatives noted the patient was no longer on site. They noted their lock on incoming access door was tampered with, scrape marks and graffiti were on the doors and outer walls of substation and their lock was present but bent. They replaced that lock on their higher-voltage side immediately.</li> <li>• Tampering and grinder marks were observed on several access doors on the treed side of the substation which is obscured from public view (<a href="#">Image 1</a> and <a href="#">Image 6</a>).</li> </ul> <p>Fire Department Statements</p> <ul style="list-style-type: none"> <li>• Substation was not declared de-energized by utility after electrocution, judged safe by first on scene/witnesses when attending and when injured was moved further from entryway nothing happened so fire members felt it was safe.</li> </ul> <p>Police Statements</p> <ul style="list-style-type: none"> <li>• The lock in which the incident occurred was declared by several witnesses to have been missing for weeks or months prior. No was lock found on the scene.</li> </ul> |

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- 2<sup>nd</sup> injured person left scene with a singed beard.

**Electrical Contractor**

- Provided report showing required maintenance was performed in the required time.
- Stated the other lock on the incoming voltage side was missing when he arrived and damaged to the inside component indicating an entry and exit point where the incident took place. The second door was also marked likely by tools during the tampering.

**Other Statements**

- Facilities Manager- Explained there was a recent change in ownership that resulted in a lapse of obtaining an operating permit however maintenance records were up-to-date.
- Grocery Store Manager- Described continued concerns around how the substation area was being used by members of the public as frequent cleaning of the ground within immediate proximity of the substation's treed side as it contained drug paraphernalia and other items.
- Employee from Grocery Store (first on scene)- Described the initial scene with multiple witnesses in close proximity to the energized substation.
- Lift Supportive Housing- Several Witnesses said Lift was aware of unlocked door to substation but according to Lift representatives no staff or management had not been informed of this issue.

**Commonalities in statements from Injured Party 1 & 2**

- Locks on this high-voltage substation had been missing for weeks or months.
- Injured parties did not understand how dangerous the substation was.

**Engineering Firm 2022**

- March 17, 2022 - Prime Engineering Electrical Maintenance Report.
- Next inspection is scheduled for September 2024, 30 months post previous inspection. Within the allowable length of time between inspections.
- Recommended several actions that were not completed including an Arc Flash study which would likely have required interior labelling.
- Shows maintenance completed as required, within required time frame.

**BC Electrical Utility**

- Utility Representative provided pictures and observations of tampering when they arrived (after patient was transported) they then to de energize substation from the vista switch).
- Maintenance contractor who was on scene as first responders came. Noted in his observations that Multiple agencies, members of the public were within several feet of the energized and unprotected buss of the unit sub that had just electrocuted the victim. This was a grave concern to him.

**Relevant code clauses****Canadian Electrical Code (CSA C22.1)**

- 2-200 General Electrical equipment shall be installed and guarded so that adequate provision is made for the safety of persons and property and for the protection of the electrical equipment from mechanical or other damage to which it is liable to be exposed.

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- 2-202 Guarding of bare energized parts 3) Entrances to rooms and other guarded locations containing exposed bare energized parts shall be marked with conspicuous warning signs forbidding entry to unqualified persons.

**36-004 Guarding**

- Energized parts of electrical equipment shall be accessible to authorized persons only.

**36-006 Warning notices**

- 1) A permanent, legible warning notice carrying the wording “DANGER — HIGH VOLTAGE” or “DANGER...V” shall be placed in a conspicuous position
- 5) Where metal enclosed switchgear is installed,
  - a) permanent, legible signs shall be installed on panels or doors that give access to energized parts,
  - b) warning of the danger of opening them while the parts are energized.

**National Electrical Testing Association (NETA) Matrix (NETA MTS-2023)**

- The recommended maintenance states a minimal frequency of maintenance must be every 36 months and 24 months for “Good practice”. CSA Z 463 ANNEX M Clause 8 and 9.18.15.
- The incident took place at 26 months after last inspection. No further checks or inspections are required to confirm or ensure securement measures are present.

**SECUREMENT**

- Lock Manufacturer - Commercial Laminated Locks.
- Brand manufacturer confirmed type of lock used was for indoor or low exposure. If exposure to the elements is a consideration, a professional padlock may be a better option as per customer service.

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### Causes and contributing factors

The cause of the incident was unauthorized access to energized, high voltage equipment, by intoxicated persons unaware of the severity of the hazard. This was contributed to by:

#### Warning Labels

1. Existing warning labels on all parking lot did not effectively inform individuals of the severity of danger within the substation.
2. The proximity of trees on the side of the enclosure that was accessed made it less likely that the warning labels would be seen.

#### Securement against Unauthorized Access

1. The access panel was likely unsecured for an extended period of time prior to the incident providing free access to energized, high voltage components.
2. Locks used to secure the panel against unauthorized access were consumer grade and provided minimal resistance to tampering.
3. There was no requirement for regular visual inspection of the of the condition of the locks that secured the unit against unauthorized access.

#### Other Considerations

It is important to note that later designs of the utility substation have advanced anti-tampering methods including security bolts. Some have locking nut mechanisms which require specialized tools to gain access to energized parts. Following the incident, the equipment remained energized while witnesses, store employees, and first responders attended to the injured individual. The investigation found that some of those present were also unaware of the potential danger that equipment posed while they worked nearby.



Image 1 – Substation within the parking lot. Tree area behind.



Image 2 – Public facing sides.





Image 3 – Faded public facing warnings.



Image 4 – Substation - Rear doors facing into trees and shows vandalism. Also shows private and public locks that were replaced after incident where previous locks were removed and damaged.



Image 5 – Substation – Public facing padlocks.

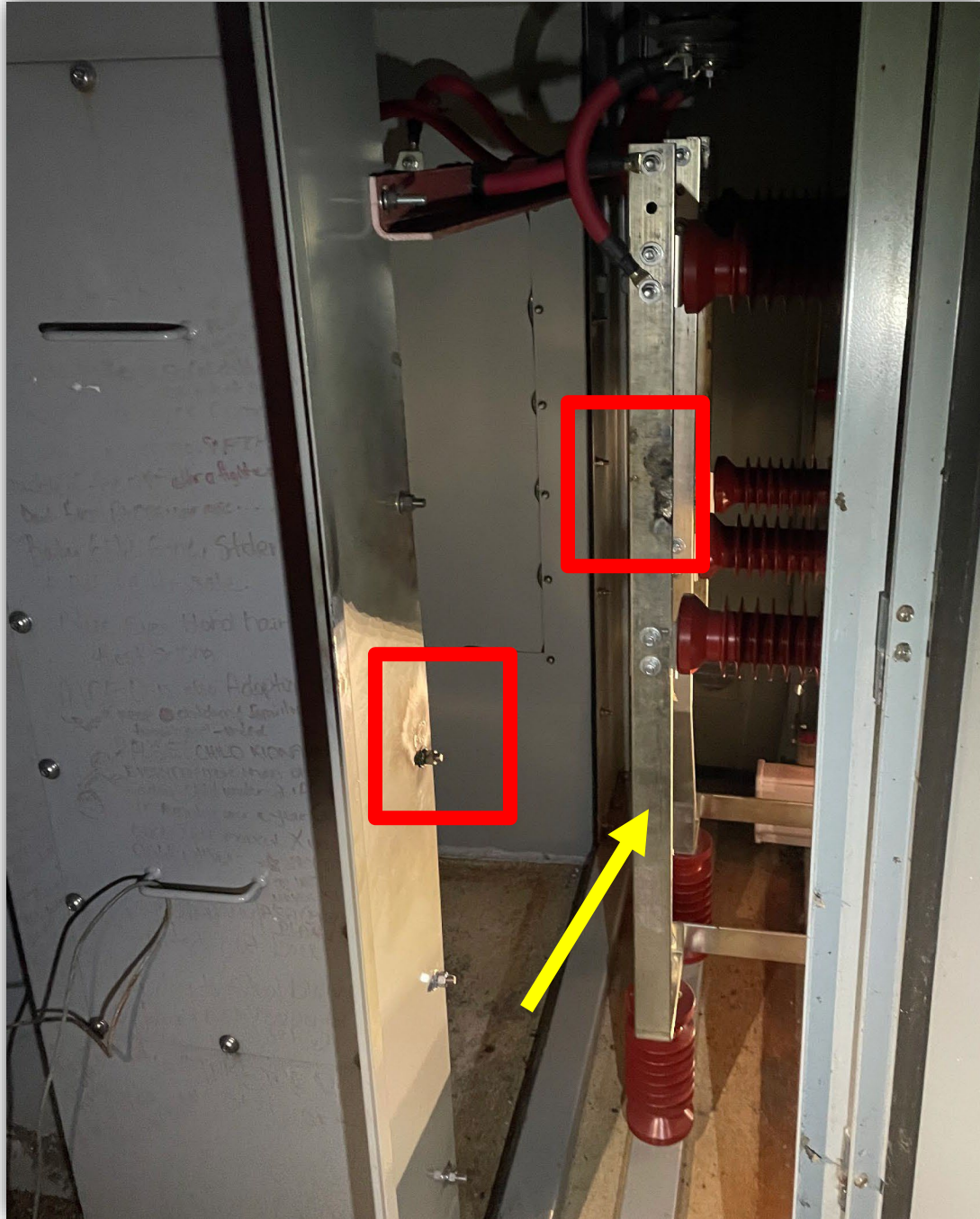


Image 6 – Red boxes show two (2) interior substation scorched contact points. This is where person one (1) of two (2) injured persons made contact inside doorway and created an entry and exit pathway for electric shock. Yellow arrow shows buss bar which is energized when the station is in operation.



Image 7 – Scrape marks caused by tools during tampering and padlock removal by unknown persons prior to incident.