Incident Summary #II-140058-2022 (#28573) (FINAL)

SUPPORTING INFORMATION	Incident Date		June 30, 2022
	Location		Terrace, BC
	Regulated industry sector		Electrical - High voltage electrical system (greater than 750V)
	Impact – Injury	Qty injuries	1
		Injury description	Worker was burnt from arc flash
		Injury rating	Moderate
	Impact – Damage	Damage description	Local disconnect contacts and the disconnect enclosure were damaged and feeder cable terminations burnt off.
		Damage rating	Moderate
	Incident rating		Moderate
	Incident overview		Clean up crew worker received burns on the hand while trying to operate a high voltage electrical switch under load. (2200-volts 3-phase).
INVESTIGATION CONCLUSIONS	Site, system and components		• The site is a wood mill industrial facility. • The WLC (whole log chipper) has a 2100-volt ac synchronous motor that is used for power factor correction. Power factor correction is used to limit power consumption. • The alternating current control and contactor was located approximately 75 meters away from the incident location in the high voltage vault. • Over current protection 400 amp 5 KV fuses. • Local disconnect (unfused) was located beside the WLC motor. • Stop start control station was located on the upper landing, which is not visible from the disconnect location below. • The direct current field disconnect includes an interlock.
	Failure scenario(s)		The whole log chipper had been turned off and locked out. The site foreman later turned back on the remote contactor to power up the chipper but there was still a lock from the clean up worker on the local disconnect for the chipper. The clean up worker without electrical qualifications later removed their own lock from the local disconnect and moved the switch handle in the upward direction to power it on. The chipper then started up and was drawing load. The clean up worker panicked and moved the disconnect switch back to the lowered, disconnected position. The site-specific lock out and tag out procedures were not followed with respect to reenergization of the equipment. When the switch was opened under load, the high voltage bridged the gap and an arc flash occurred. The switch was not designed for being opened under load and the arc flash exited through the gasket and contacted the clean up worker resulting in moderate burns.

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Facts and evidence	**Field Safety Representative statements** • The safety protocol for the site is that the shift supervisors lock is the last one to be removed. • The site procedure specifies that the first item to be locked out is the direct current (DC) for the whole log chipper as it has the control power run through its auxiliary contacts. • The start button should then be pressed to test the lock out is correct. • The DC disconnect should also be the last item to remove locks from, so the local disconnect can not be engaged under power. • The cleanup worker had removed their lock from the DC disconnect first allowing for the contactor to be closed in the HV vault which turns the control power on. **Injured worker statements** • Took off his own lock and closed the switch. • The cleanup worker then heard the motor starting, panicked, and then reopened the switch. • The cleanup worker was then burnt by escaping arc gasses and flames. • It was normal practice to open the switches himself after removing the lock. • The control should not be in the on position as it is supposed to be left in the off position. • Was off work 2.5 weeks due to the arc flash injuries. **Site findings** • The WLC disconnect was damaged while it was being operated under load. • Switch was designed to be operated in deenergized state only. • Arc created while switch was operated burnt the contacts and caused fuses to blow. • Feeder connections in HV vault also sustained damage. • Worker operating switch was burnt from escaping arc through damaged door gasket. **Arc flash characteristics** • An arc flash is the light and heat produced as part of a type of electrical explosion or discharge that results from a connection through air to ground or another voltage phase in an electrical system. • The severity of the arc flash is dependent on the available voltage and current as well as the time it takes the overcurrent protection to clear the fault. • An arc flash ionizes the surrounding air which causes extreme heat, light, sound, and pressure from the electrical equipment. • The arc flash can cause severe burns as well as hearing and vision damage to people in the area. • The arc flash can reach temperatures up to 35,000 degrees Fahrenheit.

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Causes and contributing factors	A worker without electrical qualifications operating the high voltage disconnect switch was very likely the cause of the incident. Not following the site safety procedure, including not having a qualified person (ex. supervisor) do the final re-energization and not energizing the DC control switch last were contributing factors. The start-stop control station being remotely located from the whole log chipper is a plausible contributing factor.

Photo 1 - Burnt switch contacts.

Photo 2 – Arc flash damage

Photo 3 – Whole log chipper local disconnect.

Photo 4 – Inside the local disconnect.

Photo 5 – High voltage feeder connections

Photo 6 – High voltage equipment

Photo 7 – Direct current controls in high voltage room

Photo 8 - New controls beside switch (post incident).