

Incident Summary #II-1649690-2023 (#42097) (FINAL)

SUPPORTING INFORMATION	Incident Date			December 4, 2023
	Location			North Eastern BC
	Reg	ulate	ed industry sector	Boilers, PV & refrigeration - Boiler and pressure vessel system
		Injury	Qty injuries	0
			Injury description	None
	ರ_		Injury rating	None
	Impa	Damage	Damage description	On the first of two heaters in series, the diverter valve plate temperature controller became stuck open during start up, causing a spike in temperature which activated the high temperature alarm. During this event the second heater connected in series developed a leak in the heat medium coil.
		_	Damage rating	Moderate
	Incident rating			Moderate
	Incident overview		t overview	 While starting the first turbine 2-G-8100 the diverter damper plate that directs turbine exhaust gas to the waste heat recovery unit (WHRU) heater 2-E-6255 stuck open causing a rapid increase in temperature and activating the high temperature alarm. The second turbine 2-G-8200 and WHRU heater 2-E-6920 is connected in series for adding heat to the heat medium fluid. While trying to troubleshoot the rising temperature the operator shut down the second turbine 2-G-8200. Shortly after shutting down the second turbine smoke was observed coming from this units' heat dump stack with fluid dripping from WHRU 2-E-6920 heat exchanger casing. The operator bypassed and isolated this heat exchanger.
INVESTIGATION CONCLUSIONS	Site, system and components		stem and ients	During normal operation, the turbines provide exhaust heat to the waste heat recovery units (WHRU) heat exchangers (heaters) which consists of a coil filled with a liquid heat medium (Petro-therm Oil) which transports the heat to required utility processes in the plant. As each turbine generates heat the exhaust heat diverter valve plate controls the appropriate amount of heat transfer to the WHRU units and diverts unneeded heat to the heat dump stack to avoid overheating the coils in the WHRUs.
	Failure scenario(s)		scenario(s)	During start-up the diverter valve on the first turbine 2-G-8100 stuck open and a spike in temperature occurred activating the high temperature alarm. As the heaters in series increased in temperature the second heat exchanger 2-E-6920 developed a coil tube leak.



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	Field operations confirmed that the diverter valve on the first turbine was stuck approximately 76% in the open position. The spike in temperature activated the high temperature alarm at (242 degrees C) on the first WHRU 2-E-6255.
Facts and evidence	The diverter damper manufacturer, after further analysis, reported that the damper had made contact with the damper casing and caused resistance when attempting to fully stroke (open and close) the diverter damper during the warm-up phase. The report adds that that the damper blades get heat soaked (heat up) more quickly than the damper housing and therefore the blades expand fully while the housing does not until the equipment gets fully heat soaked.
	The second WHRU heat exchanger coil was examined further at the repair shop, and it was determined that a crack occurred on the 2-inch drain nozzle. The report from the repair shop suggests that the crack in the drain nozzle may have been due to an inherent defect within the weld attachment. This report also suggests that vibrations caused during transportation and normal operations may have added in the weld crack propagation.
	It is likely that the diverter plate design may have contributed to the uncontrolled rise in temperature during start-up of the first turbine and its waste heat exchanger.
Causes and contributing factors	It is also plausible that a weld defect occurred within the second waste heat exchanger at the weld attachment of the 2-inch drain nozzle, and that vibrations in transportation and operation of the waste heat recovery unit may have added to the weld crack propagation.





Image 1 - Example of equipment overview, this a twin system like that of the affected unit. Circled object illustrates diverter plate location – designed to divert excess heat to stack above. Diverter plate image has been withheld due to proprietary reasons.





Image 2 – A general overview of the secondary waste heat recovery unit coil.





Image 3 - Secondary Waste Heat Recovery unit - Weld crack discovered on the flue gas side 2-inch drain nozzle to header.