

Potential Problems with Steam Turbine Throttle Controls

On February 14, 1993, a tank vessel transiting off the coast of California experienced a throttle control failure, which resulted in a loss of propulsion. The vessel was taking on ballast, at maneuvering speed, while enroute to Valdez, Alaska.

The throttle control failure caused the astern throttle valve to fully open, resulting in increased steam flow. This caused a surge on the steam boilers and forced the boilers to shut down on the low-low water cut out. Engine room throttle control was quickly established and the boilers were re-lit. The vessel safely proceeded to Puget Sound for investigation and repairs.

The opening of the astern throttle valve was caused by the failure of a wire resistor, known as the feedback slide wire resistor (potentiometer). The resistor, located in the astern position sensor, failed in the open position. Contributing to the casualty was the mis-positioning of the astern lockout limit switch, in the ahead sensor.

The tank vessel is designed with General Electric (G.E.) steam turbines and the G.E. "Electric Throttle Control Position Loop" control system. This control system can be found on hundreds of U.S. and foreign flag vessels with G.E. steam turbines built between 1962 and the mid 70's and the same potential for failure may exist on these vessels.

The cross-locking system that prevents the astern valve from opening at normal sea speed was automatically released because the vessel was at maneuvering speed (75-80 rpm). When the feedback slide wire resistor failed "open" and with the astern lockout limit switch mis-positioned at 75 rpm, the astern throttle valve was free to open. Subsequently, the setting of the astern lock out limit switch was changed to a lower ahead rpm set point (40-30 rpm). Lowering this setting keeps the astern throttle valve locked out to a lower ahead speed value. Care must be taken to ensure proper overlap in the sequencing of the closing of the ahead throttle valves and the opening of the astern throttle valve. If the sequencing of the ahead and the astern lockout limit switches are not correct, boiler safety valves may be lifted.

WHY IT MATTERS

This bulletin was prepared to share lessons learned with industry and the interested public. Prevention recommendations are also made to prevent similar occurrences. Sharing lessons learned is important if Washington State is to achieve its "zero spills" goal.

WEBSITE INFORMATION

<http://www.ecy.wa.gov/programs/spills/spills.html>

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Special accommodations:

To ask about the availability of this document in a version for the visually impaired call the Spills Program at 360-407-7455. Persons with hearing loss, call 711 for Washington Relay Service. Persons with a speech disability, call 877-833-6341.

This G.E. steam turbine and control system has had few other operational problems, but, like any system that contains moving parts and is over 15 years old, will begin to experience failures if not properly maintained.

Recognizing the potential dangers of these older electrical items, Ecology strongly urges each company to visually and electrically check the feedback slide wire resistors for wear and linear operation. In addition, an analysis of all similar parts in the throttle control system that may contribute to throttle failure should be undertaken and those electrical parts examined and replaced if necessary. Your local G.E. steam turbine field service representative can assist in this analysis and has the latest safety bulletins for these systems.

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