

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, D.C. 20555

August 22, 1988

NRC INFORMATION NOTICE NO. 88-67: PWR AUXILIARY FEEDWATER PUMP TURBINE  
OVERSPEED TRIP FAILURE

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose:

This information notice is being provided to alert addressees to potential problems affecting the reliability of turbine-driven auxiliary feedwater (AFW) pumps to trip during overspeed events. Similar overspeed trip mechanisms are employed on turbine-driven high-pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) pumps. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

The steam-driven AFW pumps at San Onofre Units 2 and 3 are powered by Terry steam turbines, which are provided with a mechanical overspeed trip assembly. Actuation of the trip assembly causes the steam inlet valve to the turbine to close by releasing the stop valve closure spring.

On July 3, 1988, personnel at San Onofre Unit 2 were performing low-voltage testing of the steam inlet valve to the AFW turbine. During the test, the steam inlet valve failed to close within the required period of time. In accordance with procedures, the valve technician in the pump room removed power from the steam inlet valve, which also removed power from the governor valve to the AFW turbine (fails open). Loss of power to the governor resulted in the turbine reaching an overspeed condition. Control room indication showed the pump discharge pressure to be at full scale (2000 psig), and maximum rotational speed was approximately 5000 rpm (the overspeed trip setpoint is 3500 rpm). An attempt

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was made to close the steam inlet valve from the control room, but this was unsuccessful since power had been removed. The control room operator then closed the turbine inlet isolation valve, terminating the event.

Discussion:

The licensee's investigation into this event identified the root cause to be failure of the mechanical overspeed trip device because of damage to the tappet ball located in the mechanical trip linkage. The licensee made visual inspections for damage from overpressurization of piping, valves, and instrumentation. There was no evidence of cracks, leaks, or deformation of the overpressurized piping. Analysis performed after the event revealed that piping code stresses were not exceeded.

The mechanical overspeed trip linkage consists of an emergency governor weight (located in the shaft of the turbine), an emergency tappet (see attachment 1), and linkage (not shown in attachment 1) to the trip (steam inlet) valve. During an overspeed condition, centrifugal force causes the emergency governor weight to overcome a restraining spring located in the shaft. The weight then strikes the emergency tappet, which, in turn, rises against a spring allowing the trip linkage to release the stop valve spring closure mechanism closing the steam inlet valve. Initial inspection and test results failed to duplicate the overspeed event. Upon disassembly of the mechanical trip device, visual inspection showed excessive wear on the polyurethane tappet ball. The tappet ball fits into the emergency tappet as shown in attachment 1, with the ball free to rotate. Approximately half the polyurethane was missing from the tappet ball so that the emergency governor weight could not contact the tappet ball with sufficient force to actuate the trip mechanism. The ball was also covered with a gummy substance of unknown origin.

The licensee implemented several corrective actions and plans to upgrade the mechanical trip linkage to the current vendor design (the new design has no tappet ball arrangement). The vendor recommended overspeed testing every refueling outage. Licensees may wish to consider a visual examination of the tappet ball arrangement during the refueling outage.

Information Notice 86-14, "PWR Auxiliary Feedwater Pump Turbine Control Problems," Supplement 1 to Information Notice 86-14, "Overspeed Trips of AFW, HPCI, and RCIC Turbines," and Information Notice 88-09, "Reduced Reliability of Steam-Driven Auxiliary Feedwater Pumps Caused by Instability of Woodward PG-PL Type Governors," discuss problems related to the Terry turbine overspeed trip systems.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact one of the technical contacts listed below or the Regional Administrator of the appropriate regional office.

*Charles E. Rossi*  
Charles E. Rossi, Director  
Division of Operational Events Assessment  
Office of Nuclear Reactor Regulation

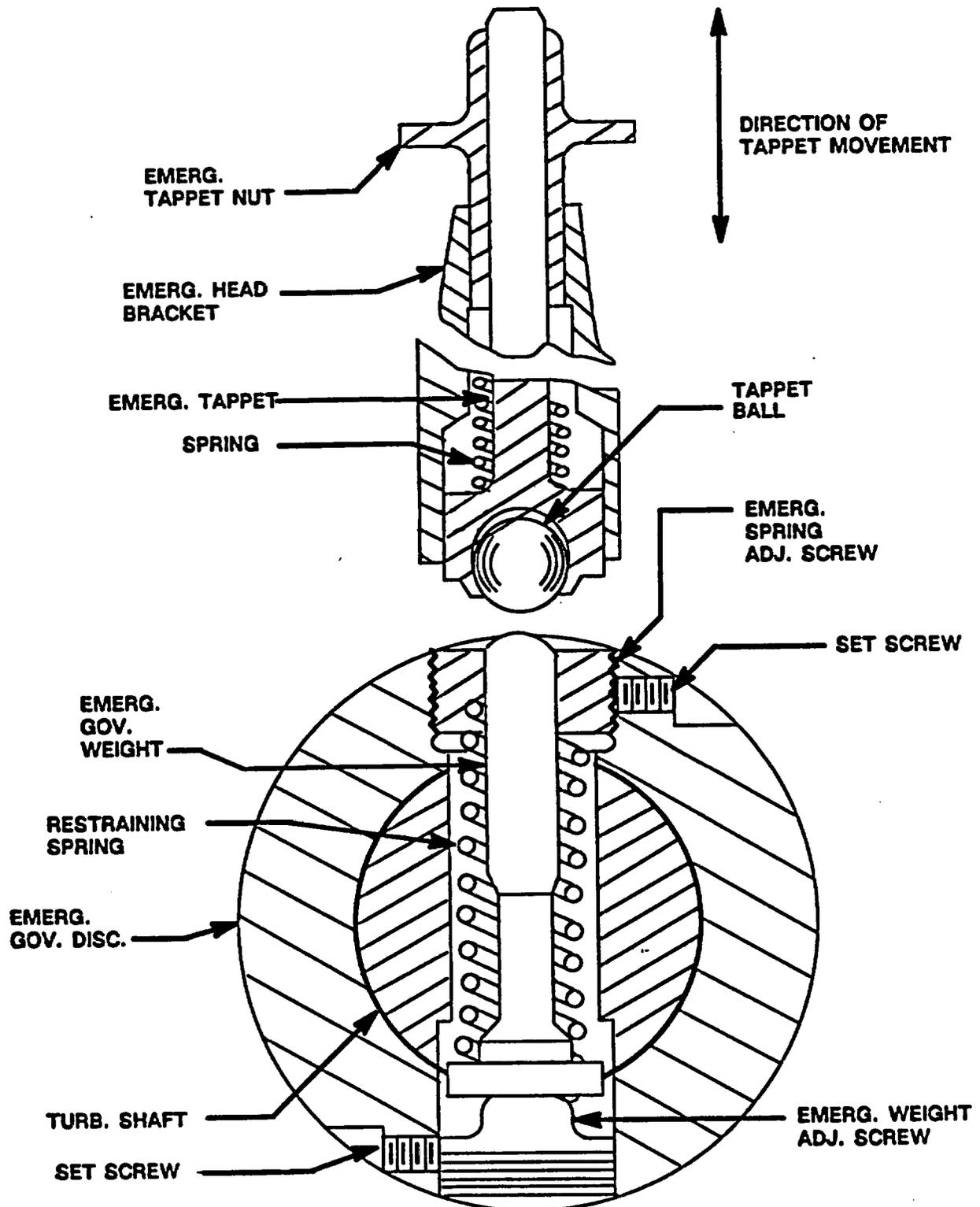
Technical Contacts: J. Thompson, NRR  
(301) 492-1175

T. Silko, NRR  
(301) 492-9059

Attachments:

1. Terry Turbine Mechanical Trip Device Tappet and Ball Linkage
2. List of Recently Issued NRC Information Notices

# TERRY TURBINE MECHANICAL TRIP DEVICE TAPPET AND BALL LINKAGE



LIST OF RECENTLY ISSUED  
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-66	Industrial Radiography Inspection and Enforcement	8/22/88	All NRC industrial radiography licensees.
88-65	Inadvertent Drainages of Spent Fuel Pools	8/18/88	All holders of OLs or CPs for nuclear power reactors and fuel storage facilities.
88-64	Reporting Fires in Nuclear Process Systems at Nuclear Power Plants	8/18/88	All holders of OLs or CPs for nuclear power reactors.
88-63	High Radiation Hazards from Irradiated Incore Detectors and Cables	8/15/88	All holders of OLs or CPs for nuclear power reactors, research reactors and test reactors.
88-62	Recent Findings Concerning Implementation of Quality Assurance Programs by Suppliers of Transport Packages	8/12/88	All holders of NRC quality assurance program approval for radioactive material packages.
88-61	Control Room Habitability - Recent Reviews of Operating Experience	8/11/88	All holders of OLs or CPs for nuclear power reactors.
88-60	Inadequate Design and Installation of Watertight Penetration Seals	8/11/88	All holders of OLs or CPs for nuclear power reactors.
88-04, Supplement 1	Inadequate Qualification and Documentation of Fire Barrier Penetration Seals	8/9/88	All holders of OLs or CPs for nuclear power reactors.
88-59	Main Steam Isolation Valve Guide Rail Failure at Waterford Unit 3	8/9/88	All holders of OLs or CPs for nuclear power reactors.
88-58	Potential Problems with ASEA Brown Boveri ITE-51L Time-Overcurrent Relays	8/8/88	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License  
 CP = Construction Permit

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\*SEE PREVIOUS CONCURRENCES

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