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Georgia Power
the southern electric system

Docket Nos. 50-321

HL-5104

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Edwin I. Hatch Nuclear Plant - Unit 1
Licensee Event Report
Clogged Servovalve Strainers Result in
Turbine Control Valve Closure and an Automatic Reactor Shutdown

Gentlemen:

In accordance with the requirements of 10 CFR 50.73(a)(2)(iv), Georgia Power Company is submitting the enclosed Licensee Event Report (LER) concerning a reduction in the electrohydraulic system pressure in the servovalve caused by clogged strainers which resulted in turbine control valve closure and an automatic reactor shutdown.

Sincerely,

J. T. Beckham, Jr.

JKB/ld

Enclosure: LER 50-321/1996-001

cc: *Georgia Power Company*
Mr. H. L. Sumner, Nuclear Plant General Manager
NORMS

U.S. Nuclear Regulatory Commission, Washington, D.C.
Mr. K. Jabbour, Licensing Project Manager - Hatch

U.S. Nuclear Regulatory Commission, Region II
Mr. S. D. Ebneter, Regional Administrator
Mr. B. L. Holbrook, Senior Resident Inspector - Hatch

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NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 5/31/95
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Edwin I. Hatch Nuclear Plant - Unit 1	0 5 0 0 0 3 2 1	1 OF 6

TITLE (4)
Clogged Servovalve Strainers Result in Turbine Control Valve Closure and an Automatic Reactor Shutdown

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR
0 1	0 4	9 6	9 6	0 0 1	0 0	0 1	2 6	9 6

OTHER FACILITIES INVOLVED (8)	
FACILITY NAME	DOCKET NUMBER(S) 0 5 0 0 0
FACILITY NAME	0 5 0 0 0

OPERATING MODE (9)	1
POWER LEVEL (10)	0 9 5

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR ?: (*Check one or more of the following*) (11)

	20.402(b)		20.405(c)	X	50.73(a)(2)(iv)		73.71(b)
	20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)		73.71(c)
	20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER (*Specify in Abstract below and in Text, NRC Form 366A*)
	20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		
	20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
	20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (include area code)
Steven B. Tipps, Nuclear Safety and Compliance Manager, Hatch	AREA CODE 9 1 2 3 6 7 - 7 8 5 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (*If yes, complete EXPECTED SUBMISSION DATE*)	X NO				

ABSTRACT (*Limit to 1400 spaces, i.e., approximately 15 single-space typewritten lines*) (16)

On 1/4/96 at 0005 EST, Unit 1 was in the Run mode at a power level of 2315 CMWT (95 percent rated thermal power). At that time, personnel noted a Main Turbine Bypass Valve (BPV) opening and the No. 2 Main Turbine Control Valve (TCV) closing. The Shift Supervisor ordered power reduced in order to close the BPV. By 0010 EST, the BPV had closed and reactor power had been reduced to approximately 72 percent rated thermal power. However, at 0020 EST, all three BPVs opened, the No. 1 and No. 3 TCVs closed, and the reactor automatically shut down on high pressure. Water level decreased due to void collapse from the rapid reduction in power and resulted in a Group 2 Primary Containment Isolation System isolation signal and closure of the Group 2 valves per design. Level reached a minimum of approximately instrument zero (158 inches above the top of the active fuel) before being restored automatically by the Feedwater Pumps. No Emergency Core Cooling Systems actuated nor were any required to actuate. Pressure reached its maximum value of 1046 psig at the time of the automatic shutdown and was controlled automatically thereafter by the BPVs. No Safety/Relief Valves lifted nor were any required to lift.

This event was caused by clogging of the TCV servovalve strainers by a foreign substance. With the strainers clogged, the electrohydraulic control system could not maintain sufficient pressure in the servovalves. The source of the substance has not yet been identified positively.

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor
Energy Industry Identification System codes appear in the text as (EIIS Code XX).

DESCRIPTION OF EVENT

On 1/4/96 at 0005 EST, Unit 1 was in the Run mode in End-of-Cycle coastdown at a power level of 2315 CMWT (95 percent rated thermal power). At that time, licensed Operations personnel noted a Main Turbine (EIIS Code TA) Bypass Valve (BPV, EIIS Code SO) opening unexpectedly. Investigation revealed the BPV was opening to control reactor pressure because the No. 2 Main Turbine Control Valve (TCV, EIIS Code TA) was closing. The No. 4 TCV had been closed prior to this event as the unit was operating at a reduced power level and remained closed. However, it should have opened in response to the increase in reactor vessel pressure caused by the No. 2 TCV closing. The Unit 1 Shift Supervisor ordered power (steaming rate) reduced to within the capacity of the remaining two TCVs by reducing Reactor Recirculation Pump (EIIS Code AD) flow rates. By 0010 EST, reactor power had been reduced to approximately 72 percent rated thermal power which corresponded to the capacity of the two TCVs and the BPV subsequently closed.

Since the unexpected closure was indicative of clogged TCV servovalve strainers, at 0012 EST Operations personnel started a second Electrohydraulic Control (EHC, EIIS Code TG) system pump in an attempt to increase EHC system pressure and prevent the two remaining TCVs from closing. However, at 0020 EST, the No. 1 and No. 3 TCVs closed and all three BPVs opened. The Shift Supervisor ordered the unit shut down manually; however, the reactor automatically shut down on high reactor vessel pressure before the manual shutdown signal was inserted.

Reactor water level decreased from its normal level of 37 inches above instrument zero due to void collapse from the rapid reduction in reactor power. Water level decreased to a minimum of approximately instrument zero (158 inches above the top of the active fuel) resulting in receipt of a Group 2 Primary Containment Isolation System (EIIS Code JM) isolation signal and closure of the Group 2 Primary Containment Isolation Valves (EIIS Code JM) per design. Level was restored automatically by the Reactor Feedwater Pumps (EIIS Code SJ) within 30 seconds of receipt of the automatic shutdown signal. No Emergency Core Cooling Systems actuated nor were any required to actuate to restore or maintain reactor water level.

Reactor vessel pressure reached its maximum value of approximately 1046 psig, the automatic shutdown setpoint, at the time of the reactor shut down. Pressure initially decreased to 780 psig as a result of the injection of relatively cold water by the Reactor Feedwater Pumps. Pressure then

increased due to decay heat and was controlled automatically at 937 psig by the BPVs per design. No Safety/Relief Valves lifted nor were any required to lift to reduce or control reactor vessel pressure.

CAUSE OF EVENT

This event was caused by clogging of the TCV servovalve strainers by a foreign substance. The physical size of the strainers is very small. The strainers are small cylinders with a diameter of approximately 0.3 inches and are approximately 0.75 inches long. Additionally, the strainers filter particles 74 microns in size. Consequently, a very small amount of foreign material may clog the strainers. The substance was a mixture of a black, gel-like or oily sludge and fibers. Laboratory analysis of the sludge by scanning electron microscope and energy dispersive X-Ray spectrometer revealed it to be a combination of a fine, solid material and a clear, colorless, viscous fluid; the solid material was composed of 23 percent Iron (as Fe_2O_3), 21 percent Chromium (as Cr_2O_3), 14 percent Calcium (as CaO), and 10 percent Magnesium (as MgO). The fibers were examined by scanning electron microscope and appeared to be of a man-made material with optical properties close to those of polyethylene.

The TCV servovalves are spring-biased in the closed direction; i.e., with a loss of EHC system fluid pressure, a spring internal to the servovalve will move the servovalve spool in the close direction causing the TCV to close. With the TCV servovalve strainers clogged by this material, EHC system fluid could not maintain sufficient pressure in the servovalve to overcome the spring force and maintain the TCVs in the open position. The TCVs closed resulting in an increase in reactor vessel pressure and an automatic reactor shutdown per design.

The source of the substance clogging the strainers has not yet been identified positively; however, the sludge may be the result of moisture in the EHC fluid interacting with elements found in the EHC system Fuller's Earth filters and the fluid itself. Information obtained from industry sources indicates that small amounts of moisture in the EHC fluid may result in the release of magnesium and calcium from the media of the Fuller's Earth filter. The magnesium and calcium then combine with the moisture and EHC fluid to form a black, gel-like or oily sludge. While the original equipment manufacturer recommended limit for moisture is less than 0.2 weight percent, the information obtained indicates that levels as low as 0.05 weight percent may be of concern.

The sludge clogging the Unit 1 TCV servovalve strainers was found by laboratory analysis using an Energy Dispersive X-Ray Spectrometer to contain magnesium and calcium. A review of the results from the routine analysis of monthly EHC fluid samples taken from both units showed a water content of 0.05 weight percent or greater every month for which data is available for at least the two

years preceding this event. Therefore, it may be possible that the sludge found on the TCV servovalve strainers is the result of a chemical reaction in the EHC system fluid caused by water. The source of the fibers found mixed with the sludge has not yet been identified; however, examination using a Scanning Electron Microscope determined they probably did not contain either magnesium or calcium.

REPORTABILITY ANALYSIS AND SAFETY ASSESSMENT

This report is required by 10 CFR 50.73 (a)(2)(iv) because of the unplanned actuation of Engineered Safety Feature systems. When the TCVs closed with reactor power greater than 30 percent, reactor vessel steam dome pressure increased as steam was generated at a rate faster than the capacity of the BPVs. The Reactor Protection System (EIIS Code JC), an Engineered Safety Feature system, actuated on high reactor vessel pressure per design when pressure increased to approximately 1046 psig. Following the automatic reactor shutdown, water level decreased due to void collapse resulting in the receipt of an automatic Group 2 Primary Containment Isolation System isolation signal on low reactor water level and closure of the Group 2 Primary Containment Isolation Valves per design. The Group 2 Primary Containment Isolation System is an Engineered Safety Feature system.

The EHC system provides clean, filtered, high pressure fluid (phosphate ester) for controlling the Main Turbine Control Valves, Stop Valves, Combined Intermediate Valves, and Bypass Valves. A portion of this fluid is directed to the servovalves for the aforementioned valves to provide the force necessary to move an internal spool. The spool, in turn, directs the correct amount of EHC system fluid to the above or below piston area of the actuators for the Main Turbine valves to move them to, or maintain them in, the desired position.

The servomotor internal to the TCV servovalve receives a current signal based upon a pressure control signal from the EHC pressure control system. The servomotor then moves a small nozzle in the servovalve, directing EHC fluid to different areas of the spool and moving the spool as needed to adjust EHC fluid flow to, and the position of, the associated TCV to maintain reactor pressure at the desired value. The spool is connected on one end to a spring; the spring is set (biased) such that it will move the spool to that position which will cause the associated Main Turbine valve to close should EHC fluid pressure to the servovalve spool be lost. This ensures EHC system pressure is not needed to trip the turbine. Because of the small diameter of the nozzle and the small clearances inside the spool area, the EHC fluid passing through the nozzle is first passed through a fine mesh strainer to remove debris potentially introduced into the fluid downstream of the EHC pump discharge filter.

An increase in reactor vessel pressure during reactor operation compresses the steam voids and results in a positive reactivity insertion. This causes the energy transferred to the reactor coolant to increase resulting in a pressure increase. The reactor is shut down automatically on high reactor vessel steam dome pressure to limit the neutron flux and thermal power increase. The automatic reactor shutdown on high pressure, along with the Safety/Relief Valves, limits the peak reactor vessel pressure to less than the American Society of Mechanical Engineers Section III Code limits.

In this event, clogged servovalve strainers caused the TCVs to close. This isolated the reactor vessel from the Main Turbine resulting in an increase in reactor vessel steam dome pressure. Although the BPVs opened in response to the increase in pressure, reactor power (steaming rate) was in excess of the capacity of the BPVs; therefore, pressure continued to increase. When pressure reached approximately 1046 psig, the reactor automatically shut down per design and terminated the pressure increase. No Safety/Relief Valves opened nor were any required to open to limit or reduce pressure.

Reactor water level decreased due to void collapse from the rapid decrease in reactor power and the Group 2 Primary Containment Isolation Valves automatically closed on low reactor water level as required. The Reactor Feedwater Pumps automatically restored water level within 30 seconds of the automatic reactor shutdown. The minimum water level reached was 158 inches above the top of the active fuel and was about 37 inches below normal water level. No Emergency Core Cooling Systems actuated nor were any required to actuate to recover or maintain water level during or following this event. All automatic functions operated per design in response to the pressure increase and the automatic reactor shutdown.

Based upon the preceding discussion, it is concluded that this event had no adverse impact on nuclear safety. This analysis is applicable to all power levels.

CORRECTIVE ACTIONS

The TCV, BPV, Combined Intermediate Valve, and Main Turbine Stop Valve servovalve strainers were replaced. The two Combined Intermediate Valve servovalve strainers were found to be clogged with the same foreign substance as the TCV servovalve strainers. The Stop Valve servovalve strainer also had evidence of the substance with about 50 percent of its surface area covered. The three BPV servovalve strainers had very little of the substance; however, their mesh size is larger than the other strainers.

The EHC pump discharge filters, the Fuller's Earth filters, and the EHC system recirculation loop fine filter were replaced as a precaution.

GPC has worked closely with the vendor, General Electric, to resolve strainer clogging. Additionally GPC has discussed this problem with other utilities and plants within the Southern Company system. Efforts to identify positively the source of the foreign substance clogging the servovalve strainers will continue. GPC is also in the process of purchasing a vacuum dehydrator in order to reduce the moisture level in the EHC fluid. Also, additional samples have been sent for laboratory analysis. Additional corrective actions will be taken as warranted, and if practical, to eliminate the substance or mitigate its adverse effects.

ADDITIONAL INFORMATION

No systems other than those already mentioned in this report were affected by this event.

No failed components caused or resulted from this event.

No previous similar events in which a foreign or unknown substance has resulted in an unplanned Engineered Safety Feature system actuation have been reported in the last two years.