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Georgia Power
the southern electric system

October 25, 1994

Docket No. 50-366 HL-4721

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

Edwin I. Hatch Nuclear Plant - Unit 2
Licensee Event Report
Less Than Adequate Procedure and Personnel Error
Result in a Condition Prohibited by Technical Specifications

Gentlemen:

In accordance with the requirements of 10 CFR 50.73(a)(2)(i), Georgia Power Company is submitting the enclosed Licensee Event Report (LER) concerning a less than adequate procedure and personnel error which resulted in a primary containment oxygen concentration greater than the technical specifications limit of 4 percent. This event occurred at Plant Hatch - Unit 2.

Sincerely,

J. T. Beckham, Jr.

JKB/et

Enclosure: LER 50-366/1994-008

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

*State of Georgia*
Mr. J. D. Tanner, Commissioner - Department of Natural Resources

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 2 | 0 5 0 0 0 3 6 6 | 1 OF 9 |

TITLE (4)
Less Than Adequate Procedure and Personnel Error Result in a Condition Prohibited by Technical Specifications

| EVENT DATE (5) | | | LER NUMBER (6) | | | REPORT DATE (7) | | | OTHER FACILITIES INVOLVED (8) | |
|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER(S) |
| 0 9 | 2 8 | 9 4 | 9 4 | 0 0 8 | 0 0 | 1 0 | 2 5 | 9 4 | Plant E. I. Hatch - Unit 1 | 0 5 0 0 0 3 2 1 |
| | | | | | | | | | FACILITY NAME | 0 5 0 0 0 |

| OPERATING MODE (9) | 1 | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR ?: (Check one or more of the following) (11) | | | |
|---|---|---|---|---|---|
| POWER LEVEL (10) | 1 0 0 | 20.402(b) | 20.405(c) | 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) | X 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 & Compliance Manager | 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| X | I K | M O N | C 5 3 9 | No | | | | | | |
| | | | | | | | | | | |

| 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 9/28/94, at 1445 EDT, Unit 2 was in the Run mode at a power level of 2436 CMWT (100 percent rated thermal power). At that time during performance of a technical specification surveillance, it was determined that the oxygen concentration in the Suppression Chamber, a portion of the Primary Containment, was 5.5% by volume. The Technical Specifications require that the Primary Containment oxygen concentration be less than 4% by volume. If this limit is exceeded, the Technical Specifications require the unit to be in the Startup mode within eight hours. Consequently, at 1445 EDT, a shutdown action statement was entered. Licensed personnel initiated nitrogen makeup to the Suppression Chamber using the Containment Atmospheric Dilution System to reduce the oxygen concentration. By 2115 EDT, the oxygen concentration in the Suppression Chamber was less than 4% and the shutdown action statement was terminated. An event review team was formed to investigate the event and its causes.

Causes of the event include a less than adequate procedure and personnel error on the part of vendor personnel and on the part of plant personnel. Corrective actions include revising procedures and training personnel.

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor

Energy Industry Identification System Codes are identified in the text as (EIIS Code XX).

DESCRIPTION OF EVENT

On 9/28/94, at 1445 EDT, Unit 2 was in the Run mode at a power level of 2436 CMWT (100 percent rated thermal power). At that time, it was determined during a Technical Specifications surveillance that the oxygen concentration in the Suppression Chamber, one of two structures that make up Primary Containment (EIIS Code NH), was 5.5% by volume. The Technical Specifications require that the Primary Containment oxygen concentration be less than 4% by volume. If this limit is exceeded, the Technical Specifications require the reactor be in the Startup mode within eight hours. Consequently, at 1445 EDT, a shutdown action statement was entered. Licensed personnel initiated nitrogen makeup to the Suppression Chamber using the Containment Atmospheric Dilution (CAD, EIIS Code BB) System to reduce the oxygen concentration. By 2115 EDT, the oxygen concentration in the Suppression Chamber was less than 4% and the shutdown action statement was terminated.

The Technical Specifications require that the Primary Containment oxygen concentration be monitored once per week. The Suppression Chamber oxygen concentration is checked once per week and the Drywell oxygen concentration is monitored and recorded continuously and also checked once per day. A containment oxygen analyzer system (EIIS Code IK), i.e., the normal oxygen analylzer, is used to perform these surveillances. A safety grade system, the post-accident $H_2/O_2$ analyzer system (EIIS Code IP), is used for the surveillance in the event a problem arises with the normal oxygen analyzer. Additionally, the $H_2/O_2$ system is operated once per month as part of a monthly operability surveillance required by the Technical Specifications.

On 9/27/94, at 0330 EDT, the oxygen concentration of the Suppression Chamber was checked as part of the weekly surveillance required by the Technical Specifications. The check was performed using the normal oxygen analyzer with the analyzer system aligned to the suppression chamber. The monitor showed an oxygen concentration of 5.5%, which was unusually high. The Drywell oxygen concentration at the time was 2.9%. Based on past experience, both areas of containment usually have about the same oxygen concentrations. The shift supervisor concluded that a problem existed with the normal analyzer and initiated a deficiency card on the system and placed the "A" $H_2/O_2$ monitor in service to measure the oxygen concentration in the Suppression Chamber. The "A" $H_2/O_2$ monitor subsequently failed downscale, at which time the "B" $H_2/O_2$ monitor was placed in service.

At 0745 EDT, the oxygen concentration in the Suppression Chamber was determined to be 2.9% using the "B" $H_2/O_2$ monitor. The oxygen concentration displayed by the monitor was 5.8%; however, in accordance with procedure 34SO-P33-001-2S, "Primary Containment Atmosphere $H_2/O_2$ Analyzer System," a correction factor was applied to the reading in order to determine the actual oxygen concentration. The licensed shift supervisor concluded from the results that the oxygen concentration was at an acceptable level, that is, less than 4%.

Plant personnel subsequently began troubleshooting the suspected problem with the normal oxygen monitor. Over the next approximately 31 hours, personnel checked the system suction lines for air inleakage, varied the system alignment in an attempt to rule out the possibility of air inleakage, obtained in-line grab samples for the purpose of validating readings, and subjected the monitors to a calibrated gas check in order to validate the $H_2/O_2$ and normal oxygen monitor outputs.

While the troubleshooting activities were in progress, Instrument & Controls personnel were repairing the "A" $H_2/O_2$ monitor. By 0030 EDT, on 9/28/94, the "A" $H_2/O_2$ monitor had been repaired and placed into service. The analyzer was used to check the oxygen concentration of the Suppression Chamber atmosphere. The sample results showed that the oxygen concentration was 2.5% when corrected in accordance with the plant procedure. It appeared that this reading validated the "B" $H_2/O_2$ analyzer results obtained on the morning of 9/27/94. Furthermore, this reading appeared to confirm that a problem existed with the normal oxygen analyzer and not with the oxygen concentration in the Suppression Chamber.

At 1445 EDT, on 9/28/94, after completion the troubleshooting activities and analyzing the data that had been obtained, it was concluded that the "A" and "B" $H_2/O_2$ monitors were providing accurate oxygen concentrations without the use of the correction factor curve, that the normal oxygen analyzer was reading accurately, and that the Suppression Chamber oxygen concentration was greater than 4%. At that point, a shutdown action statement was entered and activities were initiated to restore the oxygen concentration to less than 4%. By 2115 EDT, oxygen levels had been restored within limits and the shutdown action statement was terminated.

An event review team was formed to investigate the event and its causes.

CAUSE OF EVENT

The source of the oxygen that resulted in the high oxygen concentration in the Suppression Chamber is unknown. It appears that the oxygen was introduced to the Suppression Chamber between May of 1994 when the Primary Containment was initially inerted and 7/4/94. This is based on one uncorrected reading taken on 7/4/94 from a Postaccident $H_2/O_2$ monitor, which indicated that Suppression Chamber oxygen content was greater than 4%. A review of Operations' log books for this period of time, as well as Drywell and Suppression Chamber pressure and differential pressure strip charts revealed no evidence as to the source of the oxygen.

The causes of the high oxygen concentration existing for a prolonged period of time were a less than adequate procedure, personnel error on the part of a vendor (Comsip-Delphi) field representative, and personnel error on the part of nonlicensed plant personnel.

Prior to the Spring 1994 Unit 2 refueling outage, the Suppression Chamber oxygen concentration was checked using the post accident $H_2/O_2$ monitoring system because the normal oxygen monitor did not have a suction line from the Suppression Chamber. During the outage, a suction line was added, providing the capability of the normal oxygen monitor to sample the Suppression Chamber atmosphere. Therefore, after the outage, the once per week check was performed using the normal oxygen monitor.

The high oxygen concentration in the Suppression Chamber was not identified during the once per week Technical Specification surveillance because of a less than adequate operating procedure for the normal oxygen monitor. The Suppression Chamber suction line for the normal oxygen monitor taps off of the suction line for the "A" $H_2/O_2$ analyzer subsystem. In order for the normal oxygen monitor to sample Suppression Chamber atmosphere, the "A" $H_2/O_2$ analyzer subsystem Suppression Chamber suction valves (valves 2P33-F007 and F015) must be in the open position. Procedure 34SO-P33-002-2S, "Drywell and Torus Atmosphere Oxygen Analyzer System," the procedure for operating the normal oyxgen monitor system, did not specify the required position of these valves. It was concluded from the investigation that during all but two of the surveillances performed after the oxygen was believed to have been introduced, these valves were closed. When these valves are closed, the "A" $H_2/O_2$ analyzer subsystem Drywell suction valves are open in accordance with procedure 34SO-P33-001-2S. In this configuration, only one directional flow valve, the 2P33-F016 valve, separates the Drywell from the normal oxygen monitor. This valve is not designed to be leak tight. Consequently, with the Drywell suction valves open, a flow path is established from the Drywell to the normal oxygen monitor. Thus, it was concluded from the investigation that when plant personnel believed they had the normal oxygen monitor aligned in the Suppression Chamber

sampling mode, the system was actually sampling the Drywell atmosphere. Therefore, the high oxygen concentration in the Suppression Chamber went undetected during the surveillances. It appears that two of the surveillances were performed with the proper valve line-up. For one of the surveillances, performed on 9/6/94, the normal oxygen monitor showed the oxygen concentration to be 4.6%. The $H_2/O_2$ system was subsequently placed in service and showed that the oxygen concentration was 2% when the correction factor curve was applied in accordance with the operating procedure. (It was later determined that the correction factor curve should not have been used, which is addressed later in this report.) A deficiency card was subsequently written on the commercial grade monitor. The deficiency was dispositioned one week later when the normal oxygen monitor showed a normal oxygen level in the Suppression Chamber; however, the system was actually sampling the drywell atmosphere. The second surveillance that showed a high oxygen concentration was on 9/27/94.

The causes of high oxygen concentration not being identified when using the $H_2/O_2$ analyzer system were personnel error on the part of a Comsip-Delphi field representative and personnel error on the part of nonlicensed plant personnel. Specifically, in August of 1986, a vendor (Comsip-Delphi) field technician in troubleshooting a problem with a Unit 1 $H_2/O_2$ analyzer monitor determined that the nonlinearity of the "A" and "B" Unit 1 $H_2/O_2$ monitor oxygen cells and the "A" Unit 2 $H_2/O_2$ monitor oxygen cell exceeded the design specifications, resulting in erroneously high oxygen readings. To resolve the problem, the field technician generated a correction factor curve which was to be applied to the monitor readings. The correction factor would then compensate for the nonlinearity anomaly and result in accurate oxygen concentration readings.

The curve was unique to the cells that were in service. However, plant personnel were not aware of this. When the cells were replaced, the use of the curves should have been stopped. On 1/8/87, the oxygen cell for the Unit 2 "A" $H_2/O_2$ monitor was replaced, but the curve continued to be used for this monitor. Use of the curve with a cell that met the manufacturers specifications would result in oxygen concentration readings that were less than actual concentrations.

Until December of 1988, the correction factors were implemented through an operator aid in the Main Control Room. In December of 1988, the correction factor curve was incorporated into procedure 34SO-P33-001-2S. In August of 1989, the procedure was again revised. In this revision, nonlicensed plant personnel erroneously incorporated the use of the correction factor curve for the "B" $H_2/O_2$ monitor. Thus, beginning in August of 1989, the oxygen readings from the "B" $H_2/O_2$ monitor were nonconservative as well.

The cause of the "A" $H_2/O_2$ monitor failing during this event was a grounded control wire. Instrument & Controls personnel investigated the problem and found a hard ground on the circuit. Further investigation revealed that a control circuit wire had been pinched between the monitor and the panel when it was last inserted in the panel. Apparently, the insulation on the pinched wire degraded over time ultimately resulting in the wire grounding on the control panel.

REPORTABILITY ANALYSIS AND SAFETY ASSESSMENT

This report is required pursuant to 10 CFR 50.73(a)(2)(i)(B) in that a condition existed that was prohibited by the Technical Specifications. Specifically, the Primary Containment oxygen concentration was in excess of 4% for greater than the eight hours allowed by the Technical Specifications.

Primary Containment consists of two connected containment structures, the Drywell and the Suppression Chamber. The Drywell contains the reactor pressure vessel, reactor appurtenances, and associated portions of the reactor systems. The Suppression Chamber is a torus shaped structure positioned below the Drywell which is partially filled with water. The Drywell and Suppression Chamber are connected by relatively large pipes that terminate below the level of the water in the Suppression Chamber. The Suppression Chamber provides a means for dissipating the steam energy released to the Drywell in the event of a Loss-of-Coolant accident.

Primary Containment is designed to provide a barrier to releasing radioactivity to the environment in the event of an accident that results in a breach in the Reactor Coolant Pressure boundary. In the event of a design basis Loss-of-Coolant accident, it is postulated that hydrogen concentration in Primary Containment will reach 4%. The source of the hydrogen is the fuel cladding zirconium-water reaction, radiolysis of the reactor coolant, and corrosion of exposed metal surfaces in Primary Containment. In order to preclude combustion of the hydrogen in the Primary Containment, the concentration of oxygen is maintained below the flammability limit for hydrogen, which is an oxygen concentration of 5% by volume. The $H_2/O_2$ system is designed to be used post-accident to monitor oxygen and hydrogen concentrations in Primary Containment so that appropriate actions can be taken in the event that the hydrogen or oxygen limits are approached.

In this event, the Suppression Chamber oxygen concentration was found to be greater than 4% for a prolonged period of time. In the event of a design basis accident, at approximately five to fifteen minutes into the event, it is postulated that the Suppression Chamber-to-Drywell vacuum breakers will actuate, resulting in the oxygen in the Suppression Chamber mixing with the Drywell atmosphere. Actuation of the vacuum breakers would be the result of a high differential pressure between the two volumes due to the initiation of Containment Spray. At that point, the volumetric average of oxygen concentration would be approximately 4.4% based on the architect/engineer

calculations, which is higher than the Technical Specification limit, but lower than the flammability limit of 5%.

Prior to the vacuum breakers opening, the oxygen level would be 5.8% in the Suppression Chamber, based on the oxygen concentration readings taken on 9/28/94. However, for this oxygen level to present a safety concern, the hydrogen concentration would have to reach 4%, according to Regulatory Guide 1.7, "Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant Accident." At hydrogen concentrations below 4%, the lower limit of flammability is not reached and combustion of the hydrogen is not a concern. Based on the hydrogen generation rate predicted in the more accurate Emergency Core Cooling System (ECCS) codes used today (SAFER/GESTR), the hydrogen levels following a LOCA will not reach 4%. Consequently, an oxygen level of 5.8% in the Suppression Chamber does not create a combustible environment, and, therefore, does not present a safety concern.

In this event, a correction factor curve was used beginning in August of 1986 for the Unit 1 "A" and "B" $H_2/O_2$ analyzers and the Unit 2 "A" $H_2/O_2$ analyzer. Use of the curve provided accurate indication of oxygen concentrations until the oxygen cells for the systems were replaced. When the cells were replaced, the curve was no longer valid and its use would result in oxygen readings that were less than the actual oxygen concentrations. The cell for the Unit 1 "A" monitor was replaced on 9/21/87, for the Unit 1 "B" monitor on 10/28/88, and for the Unit 2 "A" monitor on 1/8/87. Consequently, after these dates, the readings obtained from using these monitors were nonconservative. Use of the curve was erroneously applied to the Unit 2 "B" monitor in August of 1989 during a revision to procedure 34SO-P33-001-2S. Consequently, after this date, the readings obtained from using this monitor were nonconservative.

In the event of an accident, use of the correction factor curve, while inappropriate after the above cited dates, would not have resulted in a safety concern. That is, when the emergency operating procedure action level (4% oxygen concentration) would have appeared to have been reached, the actual oxygen level would have been 7%; however, use of the curves in actuality would not have resulted in a combustible environment in Primary Containment. First of all, as discussed earlier, current ECCS codes predict that hydrogen levels will not reach the combustible limit following an accident. Therefore, the higher oxygen level in the absence of the requisite hydrogen concentrations would not create a combustible environment. Furthermore, in the unlikely event that the hydrogen level does approach the combustible limit, preplanned actions would be taken based upon hydrogen concentrations alone that would reduce hydrogen concentrations to below combustible levels.

Based on the above information, it was concluded that this event had no adverse impact on nuclear safety. This assessment applies to all operating conditions.

CORRECTIVE ACTIONS

Procedure 34SO-P33-001-2S was revised through the temporary procedure change process to delete use of the correction factor curve. The procedure will be permanently changed by 1/16/95.

The Unit 1 counterpart procedure also contains the curve and will be revised prior to unit startup from the current refueling outage.

Operations personnel on shift have been trained in the Beginning of Shift Training program regarding the elimination of the use of the correction factor curve when monitoring oxygen concentration with $H_2/O_2$ monitors.

Procedure 34SO-P33-002-2S was revised through the temporary change process to include the required position of valves 2P33-F007 and 2P33-F015 for sampling the Suppression Chamber atmosphere with the normal oxygen monitor. The procedure will be permanently changed by 1/16/95.

The Unit 1 counterpart design change for the normal oxygen monitor Suppression Chamber suction line is being implemented during the current Unit 1 refueling outage. The position of the 1P33-F007 and 1P33-F015 valves will be incorporated into procedures as part of implementation of the design change.

The "A" $H_2/O_2$ monitor was repaired and returned to service by 0030 EDT, on 9/28/94.

No personnel were counseled because the involved individuals were not or are no longer employed with Georgia Power Company.

ADDITIONAL INFORMATION

No systems other than those previously identified in this report were affected by this event.

Four events have occurred in the previous two years in which the Technical Specifications limiting conditions of operation were violated because of personnel error and less than adequate procedures. The events were reported in the following LERs:

50-366/92-27, dated 12/21/92,
50-321/93-08, dated 6/3/93,
50-321/94-07, dated 7/8/94 and
50-321/94-09, dated 8/22/94.

Corrective actions for these events included revising procedures, repairing components, revising the Technical Specifications, and training personnel. These corrective actions could not have prevented this event because they had no bearing on the operation of the Primary Containment oxygen monitoring systems.

Failed Components Information:

Master Parts List Number: 2P33-P001A
Type: Post Accident $H_2/O_2$ Analyzer
Manufacturer: Comsip-Delphi Inc.
Model Number: K-IV
Manufacturer Code: C539
EIIS System Code: IK
EIIS Component Code: MON
Root Cause Code: X
Reportable to NPRDS: No