U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-483/92022(DRP)

Docket No. 50-483 License No. NPF-30

Licensee: Union Electric Company
Post Office Box 149 - Mail Code 400
St. Louis, MO 63166

Facility Name: Callaway Plant, Unit 1

Inspection at: Callaway Site, Steedman, MO

Inspection Conducted: December 1, 1992 through January 31, 1993

Inspectors: B. L. Bartlett
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Approved By: I. N. Jackiw, Chief, Reactor Projects, Section 3A — Date: 2-12-93

Inspection Summary

Inspection from December 1, 1992 through January 31, 1993 (Report No. 50-483/92022(DRP))
Areas Inspected: Routine unannounced safety inspections of onsite follow-up of events, operational safety verification, and maintenance/surveillance was conducted.

Results: Of the areas inspected one non-cited violation was identified for failure to follow procedures (paragraph 4). A summary follows.

Operations

On December 1, 1992, the licensee experienced a partial loss of the control room annunciators. Field power supply No. 1, which had a failed capacitor, was replaced. In response to the failure, the licensee implemented newly written procedures to repair the failed power supply and to provide additional monitoring of plant parameters during the replacement. Operator response was prompt and professional. Plant management and NRC personnel were immediately informed of the situation.

On January 24, 1993, safety-related battery charger NK23 failed. The operators quickly switched controlling channels to instruments that were powered from buses not affected by the failed battery charger. Battery charger NK23 was declared inoperable while engineering and maintenance personnel were called to assist in the troubleshooting and repair effort. The timely response by operating personnel along with the efficient actions of the maintenance personnel enabled the charger to be promptly repaired. These actions avoided an unnecessary plant shutdown.

Radiological Controls

Radiological conditions in the plant appear to be improving. A number of licensee initiatives, to decrease contaminated areas, have been implemented. The auxiliary and radwaste buildings were cleaner and had fewer contaminated areas.

Maintenance/Surveillance

Several major plant components failed necessitating immediate repairs. Maintenance personnel were observed to quickly repair the failed equipment while following approved plant procedures.

During repair activities on the turbine driven auxiliary feedwater pump (TDAFWP), maintenance mechanics installed the wrong packing material. This was due to the warehouse computer data base containing incorrect information, along with the mechanics' failure to compare the work request to the packing material they actually received. Post-maintenance test activities identified the discrepancy prior to the pump being restored to an operable status. The mechanics' failure to comply with their work instructions as to the type of packing material to install was a non-cited violation.

Engineering and Technical Support

During the repair efforts mentioned above, maintenance engineering, system engineering, and design engineering were observed to be knowledgeable and supportive. Good design modifications were implemented to improve the reliability of the annunciator power supplies. A conservative evaluation of the as-found condition of the "B" charging pump was promptly performed by the engineers.

Failure of a materials engineer to correctly specify pump packing material was part of the cause for incorrect packing material being installed in the TDAFWP.

Safety Assessment and Quality Verification

Plant management immediately responded to the control room and the site during each of the equipment problems noted in the report. Good root cause analysis, corrective action identification and implementation, and follow-up by the safety-assessment and management teams were noted.

DETAILS

1. Persons Contacted

D. F. Schnell, Senior Vice President, Nuclear
*G. L. Randolph, Vice President, Nuclear Operations
*W. R. Campbell, Manager, Callaway Plant
C. D. Naslund, Manager, Nuclear Engineering
*J. V. Laux, Manager, Quality Assurance
*J. R. Peevy, Manager, Operations Support
M. E. Taylor, Assistant Manager, Work Control
D. E. Young, Superintendent, Operations
R. R. Roselius, Superintendent, Health Physics
S. E. Sampson, Supervising Engineer, Site Licensing
G. J. Czeschin, Superintendent, Planning and Scheduling
G. R. Pendegraff, Superintendent, Security
*C. E. Slizewski, Supervisor, Quality Assurance Program
*G. A. Hughes, Supervisor, Independent Safety Engineer Group
*C. S. Petzel, Quality Assurance Engineer
J. A. McGraw, Superintendent, System Engineering
R. D. Affolter, Superintendent, Design Control

*Denotes those present at one or more exit interviews.

In addition, a number of equipment operators, reactor operators, senior reactor operators, and other members of the quality control, operations, maintenance, health physics, and engineering staffs were contacted.

2. Onsite Follow-up of Events (93702)

Partial Loss of Control Room Annunciators

During this report period an annunciator field power supply failed causing a partial loss of control room annunciators. The licensee responded in a conservative and timely manner to verify the plant was in a stable condition and to replace the power supply. New plant procedures written following the October 17, 1992, loss of all control room annunciators were utilized to perform troubleshooting and repair activities.

On December 1, 1992, the licensee experienced a partial loss of control room annunciators. At 1:56 p.m., numerous control room annunciators suddenly alarmed. Using newly written procedures, the operators quickly determined which power supply had failed by comparing the annunciators specified in the procedure to which annunciators were lit. Field power supply No. 1 was determined to have failed.

The NRC inspector entered the control room just after the control room staff determined which power supply had failed and observed the licensee's repair efforts.

The licensee's actions included:

- Ensuring that enough engineers and support personnel were available to staff the technical support center in the event that all of the annunciators became inoperable.

- Requesting the instrumentation and control (I&C) department to troubleshoot the power supplies and replace the failed power supply.

- Holding a crew briefing for the equipment operators (EOs) so that they were knowledgeable of which pieces of equipment had inoperable annunciators. The EOs were sent to the field to ensure that affected equipment was closely monitored.

- Calling additional licensed operators to the control room to assist in monitoring plant performance.

- Comparing all lit annunciators to a list of annunciators which should be inoperable, to identify any discrepancies. Annunciator 80F, rod drive motor-generator (M-G) set trouble, was energized. The licensee identified that coincident with the annunciator power supply failure that the "B" rod drive M-G set had tripped off-line. This was an unexpected occurrence and troubleshooting resources were devoted to identifying the root cause of the M-G set trip.

- Checking the annunciator logic power supplies to ensure that a voltage transient had not caused one of them to fail.

At approximately 6:44 p.m., I&C personnel replaced the failed power supply and returned the annunciators to full service. Examination of the old power supply identified a failed capacitor. Apparently, a brief short to ground occurred upon the power supply failure.

A probable mechanism for the power supply short to ground causing the M-G set to trip was not identified by the licensee. The design of the circuitry was evaluated to determine if additional electrical isolation was necessary, but no design problems were identified. During the next refueling outage, the licensee intends to test the rod drive M-G set circuitry in an attempt to identify any previously undetected problems.

The licensee had experienced previous problems with the reliability of the annunciator power supply system as documented in NRC Inspection Reports 50-483/92018 and 50-483/92020. In response to the design weaknesses of the annunciator power supply system, the licensee had prepared a modification. The modification was previously scheduled to be implemented during the next refueling outage, but due to this failure the schedule was revised. NRC inspector observations of the modification are documented in paragraph 4 of this report.

Loss of Battery Charger NK23

On January 24, 1993, the licensee experienced the loss of a safety-related battery charger. During the subsequent maintenance activities, the charger was promptly repaired and was verified operable.

At about 7:00 a.m., on January 24, 1993, just after the reactor operator (RO) had relieved the watch, the RO noted that the amperage (amp) indication for charger NK23 was erratic. An operator dispatched to investigate the charger did not observe any unusual indications. The on-shift operating crew researched the work request data base and found that a similar problem with fluctuating amp readings had occurred in April 1992. At that time, the firing board had been replaced. An inoperable firing board can cause the charger to be inoperable so the operating crew decided to perform additional troubleshooting to verify the operability of the charger.

The shift supervisor (SS) decided to have the on-duty electricians take amp readings and confirm the operability of the charger. At about 9:45 a.m., the electricians began taking amp readings of each phase with a clamp-on amp meter. Each phase was found to be about equal (a normal reading); however, they were drawing about 8 amps. Normally all three phases should be drawing a total of about 28 amps. Over the next 3 to 5 minutes the electricians continued to take amp readings and observed the charger output drop to zero.

At about 9:49 a.m., the charger completely failed. The instrumentation and control circuitry supplied by the charger had their loads picked up by the safety-related batteries. The ROs immediately selected instrument channels to control pressurizer pressure and level that were not supplied by the failed charger. The batteries were rated for 900 amp-hours and the total load was about 28 amps. This meant that the batteries could carry the load for about 32 hours before loss of the channels would occur.

The licensee entered technical specification (TS) 3.8.2.1 and 3.8.3.1 for an inoperable NK charger. This TS allows the charger to be inoperable for two hours. If the charger was not restored within two hours, the licensee had six hours to shut the plant down (go to Mode 3).

The control room SS contacted the NRC inspector who was on site and informed him of the situation. The resident inspector responded to the control room and observed the licensee's actions during the replacement activities. The control room SS also contacted the Callaway plant manager, quality control inspectors, maintenance engineer (who was already on site), and the system engineer. All responded immediately to the site.

In April 1992, the licensee had repaired the charger by replacing the firing circuit board. Since the cause of the charger failure had not yet been identified it was decided to try replacing that board first.

After the board was replaced the charger still did not work, so it was decided to replace the amplifier circuit board. The battery charger functioned properly after the new amplifier board was installed.

The two hour TS time limit ran out at 11:49 a.m. and at about 12:02 p.m. the licensee commenced a plant shutdown at the rate of 20 percent per hour. At about 12:25 p.m., after the amplifier board had been replaced, the plant shutdown was stopped and reactor power was stabilized.

At about 2:22 p.m., after the charger had been tested and verified operable, the TS action statement was exited. At about 2:33 p.m., the return to full power was commenced. The lowest power level reached was about 96 percent.

Conclusions

During this inspection period the licensee experienced two challenging events. Both events were handled in a disciplined, professional manner. Immediate attention was paid to the safety of the unit and necessary repairs were promptly implemented.

No violations or deviations were identified.

3. Plant Operations (71707)

The objectives of this inspection were to ensure that the facility was being operated safely and in conformance with license and regulatory requirements and that the licensee's management control systems were effectively discharging the licensee's responsibilities for continued safe operation. The methods used to perform this inspection included direct observation of activities and equipment, tours of the facility, interviews and discussions with licensee personnel, independent verification of safety system status and limiting conditions for operation (LCOs), corrective actions, and review of facility records.

Areas reviewed during this inspection included, but were not limited to, control room activities, routine surveillances, engineered safety feature operability, radiation protection controls, fire protection, security, plant cleanliness, instrumentation and alarms, deficiency reports, and corrective actions.

Decreased Gap on Both Centrifugal Charging Pumps (CCP)

The licensee discovered that the gap between the discharge head plate and the pump casing, for both charging pumps, was smaller than allowed by procedure. After discussions with the vendor, the pump was determined to be fully operable.

On January 27, 1993, a radioactive waste helper discovered two loose nuts, on the pump's discharge plate, while performing decontamination activities on the "B" CCP. Upon notification, the SS dispatched an equipment operator to investigate. The pump was declared inoperable and

removed from service. System and maintenance engineers were requested to evaluate the conditions. The engineers determined that, in addition to the two loose nuts, the gap between the pump's discharge head plate and the casing was smaller than allowed by procedure.

The procedure specified a clearance of 40-45 mils (1,000 mils equals one inch) with a 2 mil parallel tolerance. The minimum and maximum measurements taken, by the engineers were 37 mils and 41 mils, respectively. This meant that there was a four mil parallelism.

Sixteen bolts and nuts connect the pump's discharge head plate to the pump casing. The nuts, by procedure, were not required to be torqued closed when maintenance was performed on the pump. None of the other 14 nuts were found to be loose. It is believed that four gaskets that separate the plate from the head, slowly relaxed since installation, allowing the nuts to become loose and the plate to move slightly in towards the pump.

The licensee informed the pump vendor of the as-found measurements and the vendor agree to evaluate the condition. The vendor later stated that the pump was operable with the given gap measurements and told the licensee to tighten the loose nuts while minimizing any change in the gap measurements. With engineering and management support a work request was generated to tighten the bolts. The nuts were tightened and the pump was returned to service after satisfactorily passing a retest surveillance.

The licensee checked the gap measurements on the "A" CCP the following morning and the as-found measurements were between 29 mils and 35 mils. The vendor was again contacted and informed of the new conditions.

The vendor concluded that there was no minimum gap requirement as long as no vibrational, hydraulic, or mechanical problems existed. If the gap is too large, water can leak from the pump. Apparently, there is no absolute minimum gap requirement. The "A" CCP was started for a special check of the vibrational and flow characteristics. No problems were identified. In addition, the licensee reviewed past surveillance data and identified no abnormalities in operating parameters. The vendor did not recommend an increase to any current testing frequencies.

The adverse effect from a narrow gap with out-of-tolerance parallelism would be a gradual wear of the outboard bearing. Adverse wear would shorten the life of the bearing but this would be identified through surveillance testing.

Housekeeping Problems

During plant tours the NRC inspectors routinely found ladders, equipment, and trash about the facility. Examples of this included:

- An extension ladder leaning against the essential service water suction piping to the turbine driven auxiliary feedwater pump.
- Two empty 55-gallon barrels stored in the southeast corner of the "A" emergency diesel generator room.
- The maintenance lifting rig for the reactor cavity cooling fans being stored next to the "A" train component cooling water surge tank.
- An extension ladder leaning against a column in the auxiliary building. The ladder was tied off to prevent it from falling over but it was secured to a safety-related conduit.

While none of the observed housekeeping deficiencies adversely affected any safety-related equipment or systems they did show that housekeeping efforts needed to be improved.

Conclusions

The plant helper that identified the CCP gap problem demonstrated concern for plant equipment and a professional attitude when he notified his management and the SS of the loose nuts. Timely communications and active engineering involvement was also demonstrated during this investigation and repair activity.

Additional effort needs to be devoted by the licensee to clearing up housekeeping problems.

No violations or deviations were identified.

4. Maintenance/Surveillance (62703) (61726)

Selected portions of the plant surveillance, test, and maintenance activities on safety-related systems and components were observed or reviewed to ascertain that the activities were performed in accordance with approved procedures, regulatory guides, industry codes and standards, and the Technical Specifications. The following items were considered during these inspections: the limiting conditions for operation were met while components or systems were removed from service; approvals were obtained prior to initiating the work; activities were accomplished using approved procedures and were inspected as applicable; functional testing and/or calibration was performed prior to returning the components or systems to service; parts and materials that were used were properly certified; and appropriate fire prevention, radiological, and housekeeping conditions were maintained.

a. Maintenance

The reviewed maintenance activities included:

Work Request No.	Activity
C524399	Main control board annunciator power supply replacement and testing.
C445789	Replace time delay relay in DSGN01A, containment cooler fan motor controls.
G526722	Troubleshoot charger NK23 failure.
W198655	Repair charger NK23.
W526687	Replace outboard packing on the TDAFWP.

b. Surveillance

The reviewed surveillances included:

Procedure No.	Activity
OSP-NE-00002	Periodic test of the standby diesel generator.
OSP-AL-P0002	Operability surveillance of the TDAFWP.
ISF-BB-0F435	Functional test of a reactor coolant loop 3 flow transmitter.
ISF-BB-0F445	Functional test of a reactor coolant loop 4 flow transmitter.
ISF-EG-0F108	Functional test of a component cooling water flow transmitter.
ISF-EG-000L2	Functional test of the component cooling water surge tank level transmitter.
MSE-NK-QB001	Weekly inspection on large station batteries (NK11 and NK13).
MSE-KC-FB001	Weekly diesel battery check.
MPE-ZZ-QZ001	Partial motor operated valve testing on LF HV-0105.
ETP-ZZ-ST00E	Reactor Coolant System crud release/ph transient test.

Repair of Turbine Driven Auxiliary Feedwater (TDAFW) Pump

On January 4, 1993, the licensee discovered that the wrong pump packing material had been mistakenly installed in the TDAFW pump. Since this error was discovered prior to returning the pump to service, no TS operability violation occurred.

During a pump surveillance run it was noticed that the outboard bearing cooling water coming through the packing leak-off was hotter than normal. The pump was secured and maintenance mechanics were given a work request (WR) to replace the packing.

In generating the WR, the planner identified that the pump packing was not identified on the spare parts list. As the planner continued to prepare the WR, he reviewed the vendor manual which specified Chesterton Style One as the acceptable pump packing material to be used. At that time, the planner reviewed the last pump packing replacement activity, conducted on May 17, 1992.

This review verified that the same pump packing material (Chesterton Style One), assigned under stock number (SN) 6362746, had been previously installed. After confirming that packing material under SN 6362746 met the specifications of the vendor manual, the planner used the same stock number to initiate a storeroom issue requisition to obtain the pump packing from the warehouse. The planner also transferred written work instruction notes from the May 17, 1992, maintenance work activity onto the WR; this note stated "repack pump outboard stuffing box with Chesterton Style One."

However, unknown to the planner, SN 6362746 contained two different types of packing materials. One packing material was limited to valve use only; while the other material could be used on both pumps and valves. This occurred when materials engineering had recently expanded SN 6362746 to include an additional style of packing. The additional packing material had been verified to be equivalent to the original packing material, but it was only equivalent for valves. It was not equivalent for pumps. With both packing materials under the same SN, the potential to obtain and use unapproved packing on the TDAFW pump existed.

As a result, the wrong packing material was issued from the storeroom to the mechanics. However, the mechanics did not observe the discrepancy between the issued packing material and the packing material specified by the work instructions.

The root cause of this event was a lack of attention to detail on the part of the materials engineer (ME) and the mechanics. The ME failed to ensure that packing material added to SN 6362746 was limited to use on valves only and the mechanics failed to recognize that the wrong packing was issued. As the pump failed its subsequent operability test, the TS action statement was never exited. The correct packing material was retrieved from the warehouse and properly installed on the following

shift. The pump successfully passed the retest and was returned to service.

The turbine and motor driven auxiliary feedwater pumps and the two essential service water pumps are the only safety-related pumps that use packing material. Materials engineering will set up a SN for these pumps to prevent any future occurrences. Since the licensee did not return the pump to service with the improper pump packing installed, an operability determination was not performed. In addition, the wrong packing material was not installed in any other pump.

Modification to the Annunciator System

Excellent teamwork, good communications, and good engineering support was demonstrated throughout the annunciator system modification. The work was performed in a controlled and organized manner. Management involvement was also evident during the modification implementation.

On January 21, 1993, the licensee performed part of corrective modification package 91-1037A. This design change was implemented to improve system reliability. The modification entailed replacing the existing four field power supplies (FPS), each having a one amp output capacity, with four new FPS, each having an output capacity of three amps. With this additional margin, the system would remain functional during the failure of one field power supply.

This modification also added another separate input source to two of the four power supplies. The design allowed FPS Nos. 1 and 2 to be powered from non-safety-related 125 Vdc bus, PK52; and FPS Nos. 3 and 4 to be powered from bus PK51. This additional input source eliminated the potential of a single failure that existed in the previous design (bus PK52 previously powered all four power supplies). Even though either group of supplies (Nos. 1 and 2 or Nos. 3 and 4) are fully capable of meeting loading requirements, all four power supplies will normally be aligned to carry part of the load. Each power supply can be adjusted to ensure equal loading of all four supplies is maintained. In addition, the new power supplies have voltage and current meters on the face of each power supply. If a FPS should fail, the reactor operator can readily identify which one has failed.

The design change also eliminated the need to jumper over a FPS to maintain system operability while replacing a failed power supply. This was accomplished by having the inputs and outputs of each FPS terminated to a bus arrangement. The licensee wrote procedure ITP-RK-0001, "Main Control Board Annunciator Power Supply Replacement and Testing," Revision 0, to perform this modification activity. This procedure provided step-by-step detailed instructions to the I&C technicians, who were to perform the work under the direct supervision of a construction supervisor.

In preparation for performing this work, a number of meetings were held to ensure that management and essential engineering staff members were

fully cognizant of the design change, and to solicit and address comments related to any contingent areas that could arise during implementation. Also, the performance of the modification was practiced using mockups and real equipment. The I&C technicians, under the supervision of the construction supervisor, parallelled similarly installed power supplies with the new supplies to determine, address, and adequately resolve any unforeseen problems. The new power supplies immediately picked up the load without any problems. The I&C technicians also walked through the procedure at the work site, with the construction supervisor, to identify any potential adverse implementing aspects. To facilitate the completion of work, some equipment had already been pre-assembled and labelled.

A number of precautionary measures were taken to ensure all work was conducted in a controlled manner. A thorough pre-job briefing was held, in the control room, with all pertinent personnel prior to commencing work. The plant manager was present and re-emphasized: that the construction supervisor was the single point of accountability; the need for adequate controls to be established; and the availability of pre-designated personnel on site to man the technical support center and the operations support center should an "ALERT" be declared due to the loss of all annunciators.

Plant conditions were stable and work on other plant equipment was minimized to keep operator distractions to a minimum. This approach would allow operators to effectively respond should the annunciator system become inoperable. The access to the back of the control room was limited which provided one level of control; and a second control point was established by taping off the area in the vicinity of the work area. Excellent engineering support was demonstrated during this modification. Good communication was maintained with the control room staff; a second briefing and a status update was held after the work extended into the following shift. Again, the plant manager was present and reiterated his earlier position.

Overall, the work progressed smoothly. However, the I&C technicians did experience one unexpected occurrence of an arc when terminating the temporary field power supply leads to the powered output terminal board. At this time, the construction supervisor immediately stopped all work, retrieved and reviewed the applicable electrical prints to determine the cause of the arc. Engineering personnel were actively involved in troubleshooting and resolving this occurrence. The arc was determined to be due to charging of a capacitor in the temporary field power supplies. This was not identified during mock-up practice because the new field power supplies were powered from a dead bus.

The retests consisted of a separate weekly function check of the annunciator system (P527569) and field contact verification. The weekly surveillance was satisfactorily completed. However, during field contact verification, one of the oncoming I&C technicians discovered that field contact verification could not be properly performed as directed by the procedure. The construction supervisor, again stopped

all testing activities, and made a temporary change notice to the procedure. This retest was successfully performed and the package signed-off by the shift supervisor.

Conclusions

The licensee's implementation of the annunciator modification was well performed. Pre-job briefings, single point of accountability, management oversight, practice sessions with mockups and other techniques were effectively utilized to minimize interferences with plant operation.

The failure of the maintenance mechanics to follow the requirements of the work request and install the correct packing was an example of a violation of TS paragraph 6.8.1.a., regarding implementation of procedures. However, this violation was not cited as described in paragraph 5.

5. Non-Cited Violations

Non-cited violations are matters that are identified and promptly corrected by the licensee that are apparent Severity Level IV or V violations of NRC requirements. The NRC's Enforcement Policy provides the staff the flexibility and discretion to refrain from issuing a Notice of Violation when violations meet the criteria specified in Section VII.B of the "General Statement of Policy and Procedure for NRC Enforcement Actions," 10 CFR Part 2, Appendix C. One non-cited violation disclosed during this inspection is discussed in paragraph 4.

6. Exit Meeting (71707)

The inspectors met with licensee representatives (denoted under Persons Contacted) at intervals during the inspection period. The inspectors summarized the scope and findings of the inspection. The licensee representatives acknowledged the findings as reported herein. The inspectors also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during the inspection. The licensee did not identify any such documents/processes as proprietary.