UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
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ARLINGTON, TEXAS 76011-4125

July 8, 2011

The Honorable Jeannette Mott Oxford
Missouri House of Representatives
201 West Capitol Avenue
Room 135BB
Jefferson City, MO 65101-6806

Dear Ms. Oxford:

This is in response to your March 31, 2011, letter to Dr. Gregory B. Jaczko, Chairman of the U.S. Nuclear Regulatory Commission (NRC) in which you raised questions regarding the Callaway Plant reactor shutdown on October 21, 2003. You advised us that these questions had been relayed to you by Mr. Lawrence Criscione, a former employee at the Callaway Plant, and that you were assisting him in obtaining answers to his questions.

The NRC's actions regarding the Callaway Plant shutdown on October 21, 2003 have been extensive and focused on safety. Based on the NRC's independent inspection, we concluded that the shutdown did not endanger public health and safety, and that there has been no evidence obtained during the investigation and inspection that would indicate that there was wrongdoing, such as a cover-up, involved in the plant shutdown.

The NRC has had multiple and extensive contacts with Mr. Criscione both on the telephone and in person. These included: a November 6, 2007, interview with Office of Investigations (OI) Special Agents; an October 28, 2008, meeting with the Deputy Director, Division of Reactor Projects and the Allegations Coordination and Enforcement Staff Branch Chief; a December 5, 2008, telephone discussion with the Deputy Director, Division of Reactor Projects that included Congressman Kucinich's staff; a September 25, 2009, meeting with the Deputy Director, Division of Reactor Projects and senior Region IV inspection staff to discuss the NRC's conclusions regarding his concerns. In addition, the NRC has addressed Mr. Criscione's 10 CFR 2.206 petition related to the October 2003 shutdown.

The NRC has completed its inspection and investigation related to the October 2003 Callaway Plant shutdown. Our conclusions were provided to Mr. Criscione in a letter dated February 26, 2010, which addressed each of his concerns. The attachment provides you a summary of NRC conclusions regarding Mr. Criscione's concerns. It is important to note that the NRC concluded that throughout the October 2003 shutdown, the Callaway Plant was in a safe configuration and public health and safety was assured.

In your letter, you raised several questions regarding the shutdown. In question 1, you requested whether it is the NRC's opinion that on October 21, 2003, the reactor shut down due to a combination of buildup of radioactive Xenon and a rise in average reactor coolant temperature. Technical Specifications defines six different modes of operation. These are: 1 Power Operation, 2 Startup, 3 Hot Standby, 4 Hot Shutdown, 5 Cold Shutdown, and 6 Refueling. The reactor is critical, meaning that the reactivity condition (k_{eff}) is ≥0.99, in Mode 1 Power Operations, and Mode 2 Startup. In all other modes, the reactor is subcritical with k_{eff} <0.99. Based upon the NRC's review of the facts and circumstances surrounding the shutdown, it is the NRC's conclusion that the reactor became subcritical due to a rise in reactor coolant temperature and the buildup of Xenon, both of which contributed negative reactivity. This is a design feature of a pressurized water reactor which has been analyzed and is allowed by Technical Specifications. The licensee procedure defines Mode 3 (shutdown) as having all control banks fully inserted and a shutdown margin calculated. On October 21, 2003, the control banks were inserted at 12:15 pm and the shutdown margin calculation was completed at 12:55 pm. Therefore, as documented in the control room logs, the plant was in operational Mode 3 (shutdown) at 12:55 pm. At all times, the reactor was in a safe condition.

In questions 2 through 6, you requested the NRC to provide its opinion as to what state of mind operators and managers had during the shutdown. In summary, you requested NRC's opinion of whether the reactor operators recognized that the reactor was going to shut itself down, and later on in the sequence of events, whether the reactor operators recognized that the reactor had indeed shut itself down. The NRC found that control room operators did not effectively control reactivity to maintain the reactor in the desired condition during low-power operations by properly anticipating, controlling, and responding to changing plant parameters. Operators did not use control rods or boron concentration—two means that operators can use to directly control the amount and timing of reactivity changes—to adjust for reactivity changes by xenon buildup and reactor coolant temperature changes. Specifically, reactivity was not effectively controlled in that (1) operators did not sufficiently anticipate and compensate for xenon buildup when they attempted to stabilize and hold the plant at approximately 8 percent power which caused reactor coolant temperature to continue to decrease below the technical specification required minimum temperature for criticality; (2) operators did not shut down the reactor in a deliberate manner (e.g., by inserting control rod banks), but rather the reactor became subcritical by xenon buildup and by the increase in reactor coolant temperature resulting from the operators manually tripping the main turbine; and, (3) operators did not insert control rods for nearly 2 hours after the reactor became subcritical. The reactor operators were likely to have been alerted to the fact that reactor power had dropped into the source range when the source range energized at 11:34 am as documented in the reactor operator logs.

Questions 7 and 8 are associated with the Operations Manager. You questioned whether the Operations Manager was in the control room when the first channel of source range nuclear instruments energized and whether he was interviewed as part of NRC's investigation. During the investigation into the potential willfulness to cover up the shutdown evolution, the investigators assigned to the case would have interviewed any individual necessary in order to reach a conclusion regarding alleged misconduct. These individuals would have been

determined through record reviews and through leads developed during interviews. Based upon review of the Office of Investigations report, the special agents assigned to the case did not interview the Operations Manager as part of their investigation nor was his interview required. The reactor operator logs document that at 11:34 am on October 21, 2003, the source range energized. Therefore, this information was available for Callaway management review.

With regard to question 9, in our February 26, 2010, response to Mr. Criscione, we had incorrectly identified that the shutdown margin calculation had been performed prior to tripping the turbine. We subsequently determined that the shutdown margin calculation had been performed after tripping the turbine in accordance with the procedural guidance that was in effect at the time. While the factual error is regrettable, the NRC staff has determined that it does not alter our conclusion in the matter. The NRC is taking steps to correct the record in this matter.

With regard to question 10, Nick Taylor of the NRC Region IV staff was tasked to perform an independent review of the safety significance of the October 21, 2003, Callaway plant shutdown. Mr. Taylor verified that based on the information he reviewed the Callaway plant shutdown did not endanger public health and safety. Mr. Taylor did not interview Mr. Criscione.

The NRC's primary responsibility is to ensure adequate protection of public health and safety of the American people and the environment from the civilian uses of radioactive materials. As you correctly noted in your letter, during the shutdown of the Callaway Plant on October 21, 2003, there was never any danger to the health and safety of the American people or the environment. The NRC has completed its review and found that while command and control during the shutdown was not optimum, we confirmed the plant was in a safe condition, and that there was no evidence of an attempted cover-up. Your letter did not provide any new information that the NRC had not considered or that would warrant further NRC action. If you would like to meet personally to further discuss the October 21, 2003, reactor shutdown, and the NRC's actions to address Mr. Criscione's concerns, Mr. Anton Vegel, Director, Division of Reactor Safety of my staff is willing to meet with you at your office.

Sincerely,

/RA/

Elmo E. Collins
Regional Administrator

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Category B.1	☒ Publicly Available		☒ Non-sensitive	
Category A	☐ Non-publicly Available		☐ Sensitive	

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SUMMARY OF CONCERNS

Concern

An operating crew lost control of core reactivity and left the control rods withdrawn for 90 minutes so the crew did not have to admit to upper management that the crew lost control of the reactor. In addition, the 10 degrees F temperature transient in October 2003, down to 550 degrees F, should have been documented in the Callaway Action Request system.

Resolution

Inspection, Investigation and Transient Review

The NRC specifically considered the conditions that resulted in the licensee having to shut the plant down, the procedures that were being utilized, and the operators' overall and pre-evolution practice training that had been provided for the shutdown.

The NRC conducted its review of the October 21, 2003, Technical Specification (TS) required shutdown and subsequent actions utilizing several NRC inspectors, including two of whom had been licensed reactor operators. In addition, the NRC's Office of Investigations conducted an investigation regarding potential willfulness by the operators to not document the reactor coolant system temperature transient. The Office of Investigations also assisted the NRC staff with interviews regarding the TS required shutdown and corrective actions subsequently taken.

The NRC's inspection of this concern involved discussing the transient with several operators to try and understand why the required Callaway Action Request and log entry documentation did not occur. Consistently, the answers were that much more than normal activity was occurring in the control room because of repeat failures of a 120 Vac instrument bus and the subsequent loss of the reactor coolant system letdown flow path. Each of these occurrences required entry into abnormal operating procedures along with the additional operator tasks of performing the reactor and steam plant shutdown procedures. The inspection reviewed the details of these procedures and concluded that the operators followed the procedures correctly and had maintained the plant in a safe configuration with adequate shutdown margin.

The NRC evaluated the time that elapsed from when the reactor went subcritical to the time the control rods were fully inserted into the core. The NRC found that not inserting the control rods soon after the reactor went subcritical was not consistent with effective command and control and good plant operational awareness. The NRC also determined that the delay in completing the shutdown by inserting the control rods was not an unsafe condition. The NRC verified that no procedural guidance existed with respect to timeliness as to how fast the control rods needed to be inserted.

The NRC's Office of Investigations, Region IV Field Office, initiated an investigation to determine whether there was willful misconduct in the control room personnel's failure to

document the temperature transient. The investigators met with Mr. Criscione and interviewed 11 individuals who were knowledgeable of facts pertinent to his concern, including the control room supervisor and the shift manager who were on duty during the October 21, 2003, shutdown. Based on the evidence, the Office of Investigations did not substantiate that the control room personnel at the Callaway Plant willfully failed to document a temperature transient on October 21, 2003.

Based on the NRC's assessment of the October 2003 TS required shutdown, the operating crew did not anticipate the impact of the insertion of negative reactivity from a reactivity management perspective, which then resulted in transients on the plant at the low power operating levels. The NRC determined that a temperature and pressurizer level transient just prior to the turbine trip was caused by the negative reactivity being added by the Xenon. Because Xenon continued to build in rapidly and insert negative reactivity during the down power from 100 percent power, when operators attempted to stabilize the reactor power with a constant main turbine load, a temperature transient (decrease) on the reactor plant occurred providing the necessary positive reactivity to maintain power. As a result of the temperature decrease, there was also a decrease in the pressurizer level and the subsequent letdown isolation. Earlier, Control Banks C and D had been partially inserted along with a reduction in turbine load to balance reactor and turbine power levels to approximately 7-percent. The NRC performed an approximate reactivity balance for the reactor at the point where average temperature began to decrease. The reactivity balance indicates that the continued buildup of Xenon poison in the core without a corresponding reduction in turbine load caused the decrease in temperature and related plant responses. The NRC found that the temperature transient resulted in the core temperature falling below the minimum TS required temperature for criticality and was required to be entered into the licensee's corrective action program. The NRC documented the associated non-cited violation in NRC Inspection Report 05000483/2007003. In addition, the NRC communicated to Callaway plant management NRC perspectives regarding the operating crew's performance, including the command and control aspects of the evolution.

Consideration of Off-normal and Shutdown Procedures and Training Impacts and Improvements

The NRC reviewed the licensee's training materials to determine how the licensee addressed activities and lessons learned from the October 2003 unit shutdown. The licensee did not demonstrate appropriate awareness of reactivity implications based on their actions and the plant configuration, including the impact of Xenon with a steady main turbine power output and later maintaining the control rods withdrawn after the reactor went subcritical. The NRC noted that operator training for low power operations did not adequately address the impact of system responses, command and control with procedural implementation, and reactivity management.

The NRC reviewed both initial license training and licensed operator continuing training materials as it is currently being implemented. The NRC identified that both the initial license and licensed operator continuing training incorporated plant shutdowns from a low power of 20 to 30 percent power to a Mode 3 condition. This training included both simulator and classroom

discussions on the performance of the task and the necessary procedures to accomplish the evolution. Emphasis was placed on the actions required by the procedure and the sequence of these actions. In addition, the licensee created a job performance measure for the licensed operator continuing training to prepare a Xenon prediction for changes in power. The licensee also has performed several pre evolution practice-training activities for various plant power changes and critical evolutions during plant startup and shutdown.

The NRC reviewed training materials and identified several references to the October 2003 event and other indirect training activities to enhance operator performance during the shutdowns. The inspector noted that a licensed operator continuing training simulator session included a failure of the safety-related instrument buss inverter NN11. Loss of this inverter led to the TS required shutdown in October 2003. The simulator session required the crew to respond to a loss of the NN01 bus, enter the appropriate procedure, and transfer the bus from its alternate source to a backup power supply. The documented purpose of the training was to simulate a recreation of the October 2003 event.

As part of another simulator session, the licensee included operating experience as part of the training materials. The operating experience also referenced the 2003 event and documented the reactor coolant system cooldown that went below the technical specification minimum temperature for criticality. The training documented that the crew did not make a log entry for the unplanned TS entry. In addition, the operating experience went on to explain that the crew did not initiate a corrective action document for the problems during the shutdown, the temperature transient, the loss of letdown, and the unplanned TS entry. The same simulator session included another operating experience section that documented specific details of the cooldown problems encountered and the operators' response to the cooldown issues.

The NRC found that the control room staff was occupied with the response to the off-normal inverter and letdown isolation procedures. The loss of the inverter did result in significant control room and equipment operator attention to assist with troubleshooting and restoring the failed inverter. The NRC determined that the operating crew's actions were consistent with the off-normal, low power, and shutdown procedures. The NRC did not find that the implementation of either off-normal procedure prevented the control room operators from inserting the control rods at any time during the shutdown. A review of the low power and shutdown procedures, the sequencing of activities, and the pre-evolution practice training did not provide the operators with the expected focus on reactivity management, including the impact of the plant configuration on transient initiators. However, the operator responses were not inconsistent with the procedures, the plant configuration, or their training.

Conclusion

The NRC found that reactivity (i.e., reactor power) was not well managed during the October 2003 shutdown at low power levels and this resulted in the reactor coolant temperature and pressurizer transients. The procedures associated with low power operations and shutdown, the activities to recover the failed inverter, and the lack of operating experience with the plant at

low power levels, all contributed to the complexity of the shutdown and the length of time the control rods were not inserted into the reactor core. The licensee's actions that were taken following the main turbine trip demonstrated that there was not an attempt to recover the plant and return to power operations. Given that conclusion, appropriate attention to reactivity management would have the operators insert the control rods well before the time they were actually inserted. There were essentially no safety implications from the plant configuration and adequate shutdown margin was maintained throughout the 90- to100-minute period from the turbine trip to the insertion of the control rods.

The NRC did not substantiate that the operations crew left the control rods withdrawn so they would not have to admit to upper management that the crew lost control of the reactor.

The NRC substantiated that the licensee failed to document the temperature transient in the corrective action program. This was a violation of an NRC requirement and is documented as a non-cited violation in NRC Inspection Report 05000483/2007003, Section 4.OA7.

Concern

An inadequate procedure step, which was performed during the 2003 shutdown, led to the 10 degree F temperature drop to below the minimum temperature for criticality.

Resolution

The NRC reviewed the Checklist 0005 Procedures OTN-AC-0001, "Turbine Generator Shutdown," Addendum 3; and OTN-AB-0001, "Main Steam and Steam Dump Systems," related to opening of turbine and main steam line drains following a turbine trip. Procedure OTN-AC-0001 does have a precaution stating that turbine drains should remain open during shutdowns unless closed to prevent excessive cool down. This precaution has been in the procedure throughout the entire plant operating period. The NRC identified no other procedures related to the referenced components that could result in decreasing reactor coolant system temperature. The NRC reviewed the corrective actions from Callaway Action Requests 200704820 and 200701278. These Callaway Action Requests were associated with shutdown transients that incurred equipment failures and undesired reactivity and reactor coolant system temperature transients associated with Xenon buildup and main turbine trips.

There was no procedural step found in the referenced procedures that could be determined to have solely and conclusively caused the reactor coolant system temperature drop below the minimum temperature for criticality. The training department did initiate Course Enhancement 6486 to have "PREP" or "pre-evolution practice" training for indications of excessive cooldown.

The concern that an inadequate procedure step, which was performed during the 2003 shutdown, led to the 10 degree F temperature drop to below the minimum temperature for criticality, was not substantiated.

Concern

The Callaway Plant did not investigate Callaway Action Request 200704911, “Evaluate Operations Dept.'s Performance in Analyzing Plant Transients,” in a timely manner and that their investigation was inadequate.

Resolution

The assessment of the corrective actions associated with reactivity management was documented in NRC Integrated Inspection Report 05000483/2009003. The NRC assessment documented the facts surrounding the licensee’s progress in addressing reactivity management and procedure quality and focused on current licensee performance. However, reactivity management and procedure quality were not effectively addressed until well after the October 2003 reactor shutdown. In 2007, the licensee began to address earlier problems encountered with plant shutdowns and reactivity management, and provided further guidance in 2009 that appreciably strengthens operations and provided cautions and management oversight for extended operations at low power levels following a plant down power.

During a review of items entered in the licensee’s corrective action program, the NRC focused on corrective actions associated with reactivity management. The NRC discussed reactivity management with control room operators, reactor engineering, and training personnel.

In 2004, the licensee performed a reactivity management self assessment and documented the results in Report SA04-OP-F01. Two of the attribute shortfalls of the report stated, in part, that a senior reactor operator does not provide proper oversight during reactivity manipulations by ensuring full attention is given to the proper setup and operation of reactivity controls, and a dedicated reactivity reactor operator is not assigned to maintain dedicated oversight for reactivity manipulations involving lengthy evolutions. Although identified as attribute shortfalls by the assessment team, the report documented that the licensee would not correct the shortfalls because the station’s expectations were being met with the reactivity management standards in place at that time.

In 2007, licensee personnel initiated several corrective action documents including Callaway Action Request 200704911 to address weaknesses in operator performance during plant shutdowns. In addition, the licensee initiated corrective action documents to address industry operating experience and industry initiatives on reactivity management. As a result of the issues identified in the corrective action documents, the licensee revised procedures to provide additional instructions to operators on plant shutdowns and specifically, control of the plant during low power operations following a unit down power. Additional corrective actions established the dedicated senior reactor operator to serve as a reactivity monitor during power changes until stable power is achieved and reactivity management plans for operator use during power changes. The NRC concluded the licensee’s actions associated with Callaway Action Request 200704911 were adequate.

In 2009, the licensee performed a reactivity management self assessment and identified further actions to strengthen reactivity management performance. The issues identified during the assessment were documented in the corrective action program. One item the licensee identified was the need for additional barriers to ensure a conservative decision making process is used when recommending operation of the plant at lower power levels for an extended period of time and that such evolutions should be discouraged. This management directive was developed and implemented in 2009.

The NRC did not substantiate this concern. The corrective actions performed by the licensee for Callaway Action Request 200704911, “Evaluate Operations Dept.'s Performance in Analyzing Plant Transients,” were adequate to address the reactivity management concerns from the October 2003 shutdown.