UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
612 EAST LAMAR BLVD, SUITE 400
ARLINGTON, TEXAS 76011-4125

July 1, 2011

Brian J. O'Grady, Vice President-Nuclear
and Chief Nuclear Officer
Nebraska Public Power District
72676 648A Avenue
Brownville, NE 68321

Subject: COOPER NUCLEAR STATION - NRC SPECIAL INSPECTION REPORT 05000298/2011008

Dear Mr. O'Grady:

On May 3, 2011, the U.S. Nuclear Regulatory Commission (NRC) completed a special inspection at your Cooper Nuclear Station to evaluate the facts and circumstances surrounding the exposure of three workers to higher than expected dose rates while removing an intermediate range monitor shuttle tube from beneath the reactor pressure vessel. The enclosed report documents the inspection findings that were discussed on June 9, 2011, with Mr. A. Zaremba, Director, Nuclear Safety Assurance, and other members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed plant personnel.

Based upon exceeding the deterministic criteria for radiation safety specified in NRC Management Directive 8.3, "NRC Incident Investigation Program," the NRC initiated a special inspection in accordance with Inspection Procedure 93812, "Special Inspection." The basis for initiating the special inspection was the work activity led to unplanned changes in restricted area dose rates in excess of 20 rem per hour in an area where personnel were present. The focus of the inspection was the event that took place on April 3, 2011, when three workers removed an intermediate range monitor shuttle tube from beneath the reactor pressure vessel and dose rates in the area went from 120 millirem per hour to 39 rem per hour at 30 centimeters from the tip of the shuttle tube, which was the source of the excess dose. The focus areas for review are detailed in the Special Inspection Charter (Attachment 2). On April 5, 2011, the NRC determined that the inspection would be conducted and the onsite inspection started on April 11, 2011.

This report documents six NRC-identified findings of very low safety significance (Green). Five of these findings were determined to involve violations of NRC requirements. However, because of their very low safety significance and because they are entered into your corrective action program, the NRC is treating these findings as noncited violations, consistent with Section 2.3.2 of the NRC Enforcement Policy. If you contest the violations or the significance of the noncited violations, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission,

ATTN: Document Control Desk, Washington, D.C. 20555-0001, with copies to the Regional Administrator, U.S. Nuclear Regulatory Commission, Region IV, 612 E. Lamar Blvd, Suite 400, Arlington, Texas, 76011-4125; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001; and the NRC Resident Inspector at the facility. In addition, if you disagree with the cross-cutting aspect assigned to any finding in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region IV, and the NRC Resident Inspector at the facility. The information you provide will be considered in accordance with Inspection Manual Chapter 0305.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response, if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. To the extent possible, your response should not include any personal privacy or proprietary, information so that it can be made available to the Public without redaction.

Sincerely,

/RA/

Vincent G. Gaddy, Chief
Project Branch C
Division of Reactor Projects

Docket: 50-298
License: DPR-46

Enclosure: NRC Inspection Report 05000298/2011008
w/Attachments:

Attachment 1: Supplemental Information
Attachment 2: Special Inspection Charter
Attachment 3: Pictures and Diagrams

cc w/Enclosures:
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U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket:	05000298
License:	DPR-46
Report:	05000298/2011008
Licensee:	Nebraska Public Power District
Facility:	Cooper Nuclear Station
Location:	72676 648A Avenue Brownville, NE 68321
Dates:	April 11 through May 3, 2011
Inspectors:	D. Overland, Resident Inspector, Waterford 3 Steam Electric Station B. Tharakan, CHP, Resident Inspector, South Texas Project
Approved By:	Vince Gaddy, Chief Project Branch C Division of Reactor Projects

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ATTACHMENTS

SUMMARY OF FINDINGS

IR 05000298/2011008; 04/11/11 – 05/03/11; Cooper Nuclear Station; Special inspection to evaluate unexpected doses to workers performing under-vessel maintenance activities.

The report covered one week of onsite inspection and in-office review through May 3, 2011. Two resident inspectors performed the inspection. Five Green noncited violations and one Green finding were identified. The significance of most findings is indicated by their color (Green, White, Yellow, or Red) using Inspection Manual Chapter 0609, "Significance Determination Process." The cross-cutting aspect is determined using Inspection Manual Chapter 0310, “Components within the Cross Cutting Areas.” Findings for which the significance determination process does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 4, dated December 2006.

A. NRC-Identified and Self Revealing Findings

Cornerstone: Occupational Radiation Safety

- Green. The inspectors identified a noncited violation of Technical Specification 5.4.1, for a failure to implement procedures described in Regulatory Guide 1.33, Appendix A. Specifically, the licensee failed to implement procedures that provide guidance on creating clear, accurate work instructions. As a result, the work instructions were not able to be completed as written and needed parts were not available. This directly contributed to three instrumentation and control technicians receiving an unexpected radiation dose. A site stand-down was held to discuss the lessons learned and the event was entered into the licensee’s corrective action program as Condition Report CR-CNS-2011-4431.

  This deficiency was reasonable for the licensee to foresee and prevent occurrence. The finding was more than minor because it is associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure the adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation. The inspectors evaluated this finding using Inspection Manual Chapter 0609, Appendix C, “Occupational Radiation Safety Significance Determination Process.” The inspectors determined that the finding is of very low safety significance (Green) because it was not associated with ALARA planning or work controls, there was no overexposure, there was no substantial potential for an overexposure, and the licensee’s ability to assess dose was not compromised. The finding has a cross-cutting aspect in the work practices component of the human performance area because the licensee did not effectively communicate expectations regarding procedural compliance and that personnel follow procedures. Specifically, the licensee displayed a cultural behavior that unacceptable behaviors, such as failing to follow procedures, are acceptable as long as the outcome is desirable [H.4.(b)](Section 3.1).

- Green. The inspectors identified a noncited violation of Technical Specification 5.4.1, for failure to implement procedures described in Regulatory Guide 1.33, Appendix A. Specifically, the licensee failed to implement procedures that provide guidance on recognizing risk associated with a maintenance activity and properly accounting for that risk. This directly contributed to three instrumentation and control technicians receiving an unexpected radiation dose. A site stand-down was held to discuss the lessons learned and the event was entered into the licensee's corrective action program as Condition Report CR-CNS-2011-4435.

  This deficiency was reasonable for the licensee to foresee and prevent occurrence. The finding was more than minor because it is associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation. The inspectors determined that the finding is of very low safety significance (Green) because it was not associated with ALARA planning or work controls, there was no overexposure, there was no substantial potential for an overexposure, and the licensee's ability to assess dose was not compromised. The finding has a cross-cutting aspect in the work control component of the human performance area because the licensee did not plan work activities by incorporating risk insights. Specifically, the licensee developed a work package that failed to recognize the risk associated with the activity [H.3(a)](Section 3.1).

- Green. The inspectors identified a finding for a failure to implement human performance procedures. Specifically, the licensee failed to implement procedures that provided guidance on conducting pre-job briefs, preparing work in the field, and informing technicians on what to do when the workers encountered a problem. This contributed to three instrumentation and control technicians receiving an unexpected radiation dose. A site stand-down was held to discuss the lessons learned from the event. This was entered into the licensee's corrective action program as Condition Report CR-CNS-2011-4258.

  The finding was more than minor because it is associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure the adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation. The inspectors evaluated this finding using Inspection Manual Chapter 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process." The inspectors determined that the finding is of very low safety significance (Green) because it was not associated with ALARA planning or work controls, there was no overexposure, there was no substantial potential for an overexposure, and the licensee's ability to assess dose was not compromised. The inspectors determined that the apparent cause of this finding was the licensee's failure to promote the use of human performance tools to ensure job tasks were properly completed. Therefore, this finding has a cross-cutting aspect in the work practices component of the human performance area because the licensee did not adequately communicate human error prevention techniques such that work activities are completed safely [H.4(a)](Section 3.2).

- Green. The inspectors identified a noncited violation of Technical Specification 5.4.1, for a failure to comply with procedures described in Regulatory Guide 1.33, Appendix A. Specifically, the licensee failed to implement procedures and a work order instruction that required the work order to be returned to work planners and revised if the original work scope is changed or a problem is encountered. This directly contributed to three instrumentation and control technicians receiving an unexpected radiation dose. A site stand-down was held to discuss the lessons learned from the event. This was entered into the licensee's corrective action program as Condition Report CR-CNS-2011-4428.

  The finding was more than minor because it is associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure the adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation. The inspectors evaluated this finding using Inspection Manual Chapter 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process." The inspectors determined that the finding is of very low safety significance (Green) because it was not associated with ALARA planning or work controls, there was no overexposure, there was no substantial potential for an overexposure, and the licensee's ability to assess dose was not compromised. The finding has a cross-cutting aspect in the decision making component of the human performance area because the licensee did not use conservative assumptions in decision-making. Specifically, the licensee did not validate the assumptions made when considering the change in work scope [H.1(b)](Section 3.3).

- Green. The inspectors identified a noncited violation of Technical Specification 5.7.2, for the failure to adequately brief radiation workers entering a locked high radiation area. Specifically, the radiation protection pre-job briefing failed to make workers knowledgeable of the radiation dose rates that may be encountered when pulling the intermediate range monitor shuttle tube from under the reactor pressure vessel and failed to identify any change in work scope or breach of the nuclear instrument system. This resulted in the workers being exposed to higher than expected dose rates. The workers immediately evacuated the area and contacted radiation protection. The licensee held a site stand-down to discuss lessons learned and this finding was entered into the licensee's corrective action as Condition Report CR-CNS-2011-04441.

  The finding was more than minor because it is associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure the adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation because workers were exposed to higher dose rates. The inspectors evaluated the significance of the finding using NRC Inspection Manual 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process," dated August 19, 2008. The inspectors determined that the finding is of very low safety significance because it was not associated with ALARA planning or work controls, there was no overexposure, there was no substantial potential for an overexposure, and the licensee's ability

to assess dose was not compromised. In addition, the finding had a cross-cutting aspect in the work control component of the human performance area because the licensee did not appropriately communicate, coordinate, and cooperate with each other during the radiation protection pre-job briefing and failed to keep personnel apprised of plant conditions that may affect work activities to ensure radiological safety was maintained [H.3(b)](Section 4.3).

- Green. The inspectors identified a noncited violation of Technical Specification 5.4.1(a), for the failure to follow Radiation Procedure 9.EN-RP-141, "Job Coverage," Revision 8. Specifically, the radiation protection personnel were monitoring workers pulling the intermediate range monitor shuttle tube from under the reactor pressure vessel and failed to implement radiation protection job coverage requirements that resulted in the workers being exposed to dose rates as high as 39 rem per hour at 30 centimeters from the tip of the shuttle tube. The licensee immediately evacuated and restricted access to the area. This finding was documented in the licensee's corrective action program as Condition Reports CR-CNS-2011-04442, CR-CNS-2011-04255, CR-CNS-2011-04595, CR-CNS-2011-05443, CR-CNS-2011-05444, CR-CNS-2011-05446, CR-CNS-2011-05447, and CR-CNS-2011-05448.

  The finding was more than minor because it is associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure the adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation because workers were exposed to higher dose rates. The inspectors evaluated the significance of the finding using NRC Inspection Manual 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process," dated August 19, 2008. The inspectors determined that the finding is of very low safety significance because it was not associated with ALARA planning or work controls, there was no overexposure, there was no substantial potential for an overexposure, and the licensee's ability to assess dose was not compromised. In addition, the finding has a cross-cutting aspect in the work practices component of the human performance area because the licensee failed to use human error prevention techniques such as self-checking and peer-checking to ensure that job coverage procedures were followed [H.4(a)](Section 4.4).

B. Licensee-Identified Violations

None.

REPORT DETAILS

4OA3 EVENT FOLLOW-UP

1.0 Special Inspection Scope

On April 2, 2011, while licensee workers were removing an intermediate range monitor shuttle tube assembly from the reactor pressure vessel, they deviated from the written work instructions. Workers under the vessel received dose rate alarms and exited the area. The workers' dosimeters measured dose rates of 1.35 Rem per hour, 14.3 rem per hour, and 763 millirem per hour.

The inspection charter (refer to Attachment 2) required the team to: (1) develop a timeline for the sequence of events, including actions taken prior to and post event, as well as the associated decision-making process, (2) assess the licensee's procedural compliance during work order preparation and execution, including ALARA and radiological work permit considerations, (3) characterize the area dose rates and dose received by personnel, (4) review causal determination and short term corrective action adequacy, and (5) review previous activity performance and compare to current activity performance.

The team performed their reviews in accordance with NRC Inspection Procedure 93812, "Special Inspection Procedure." The team used the requirements in 10 CFR Parts 19, 20 and 50, the licensee's technical specifications, and the licensee's procedures required by technical specifications as criteria for determining compliance. The team reviewed licensee procedures, corrective action documents, as well as work orders and radiological work permits for the maintenance activity. The team interviewed station personnel regarding the events, compared this event to previously performed evolutions, and assessed the adequacy of the licensee's corrective actions. A list of specific documents reviewed is provided in Attachment 1. The charter for the special inspection is provided as Attachment 2.

2.0 Event Description and Chronology

2.1 Event Summary

On April 2, 2011, instrumentation and control technicians prepared to remove the source range monitor B and the intermediate range monitor C shuttle and dry tube assemblies from the top of the reactor vessel in accordance with Work Orders 4741006 and 4741002. Each intermediate range monitor and source range monitor detector is contained inside a shuttle tube. This shuttle tube is fixed to a drive tube that a drive mechanism moves up and down inside a dry tube. The entire tube assembly, along with the detector was to be replaced. Arrangement of these components is depicted in Attachment 3.

During the pre-job brief, the workers discussed the activity to be performed and the tools needed. Nose cones were identified as a needed component, but the type of nose cones (male or female threads) and their location was unknown. In particular, workers discussed whether the shuttle tube could be removed from the bottom of the core, rather than the top (as procedurally directed), however no resolution was achieved.

Prior to beginning work, two nose cones were located, one male-threaded and one female-threaded. The workers proceeded to conduct the work activity. Source range monitor B drive tube was removed and the male-threaded nose cone was installed on the bottom of the dry tube, sealing the shuttle tube inside. Intermediate range monitor C drive tube was removed, but no other male-threaded nose cones were available to install on the lower end of the dry tube prior to removal.

When the workers reported this issue to the outage control center, the outage control center staff gave permission to the workers to remove the shuttle tube from the bottom of the reactor vessel, rather than sealing it inside the dry tube for removal above the reactor vessel (as originally planned). The licensee did not modify either the associated work order or the corresponding radiation work permit to reflect this change.

As the workers removed the shuttle tube from the bottom of the vessel, the three workers under the vessel received dose rate alarms. The workers then set the tip of the tube on the floor at the 888 foot elevation and exited the area. The workers' dosimeters measured dose rates of 1.35 rem per hour, 14.3 rem per hour, and 0.763 rem per hour.

Surveys taken of the shuttle tube, during recovery operations, found that the tip of the shuttle tube measured 3,226 rem per hour on contact and 39 rem per hour at 30 centimeters, and that the general area dose rate was 4.6 rem per hour at waist level, increasing to 8.6 rem per hour at waist level near the tube.

2.2 Sequence of Events

December 2009 – The licensee identified the need to replace intermediate range monitor C. Work Order 4741002 was generated to replace intermediate range monitor C components. The work order contained, in part, the following actions:

- Remove dry tube, shuttle/drive tube, and detector from **top** of reactor
- Install new dry tube and shuttle/drive tube from top of reactor
- Install new detector

January 2010 – A planner was assigned for Work Order 4741002.

May 2010 – Planning for Work Order 4741002 begins.

November 2010 – The ALARA review of Work Order 4741002 was deemed satisfactory.

December 2010 – Instrumentation and control supervisory walkdown of Work Order 4741002 was completed (not the same supervisor that performed the job).

February 2011 – The instrumentation and control lead technician completed shop walkdown of Work Order 4741002. This completed planning of the work order. The same technician later performed the job.

April 2, 2011 – (times approximated)

1730 – During maintenance supervisor turnover, the off-going supervisor identified that the day-shift crew had pulled the detectors, and was ready to remove the drive mechanisms and tube assemblies.

1830 – The outage control center brief identifies that the source range monitor and intermediate range monitor work was a priority. The “backup plan” to remove the shuttle tube from under the vessel is not discussed at the brief.

2000 – Outage control center called instrumentation and control superintendent to get status of locating nose cones for source range monitor and intermediate range monitor work. Only one nose cone located. Outage control center inquired about an alternate plan. Back-up plan was to pull the shuttle tube manually from below. Instrumentation and control told outage control center that the tube was made of titanium (easily bendable and nonirradiated). Outage control center requested instrumentation and control to brief radiation protection and ensure they understood and approved the back-up plan.

2030 – Inspection of top guide was complete, so refuel floor staff would be ready for dry tube removal at midnight.

2130 – Instrumentation and control superintendent informed that one nose cone had been located. Refuel floor manager looks for another nose cone.

2200 – The lead instrumentation and control technician conducted a shop brief for upcoming under-vessel work on the source range and intermediate range monitors. Attendees were the three technicians and instrumentation and control supervisor. The feasibility of pulling the shuttle tube from below the vessel is discussed, but no resolution was achieved.

2206 – Second nose cone located. However, the threads on this nose cone did not match the threads on the other nose cone, so technicians head to the drywell with one male-threaded and one female-threaded nose cone. They were not sure which would be needed.

2230 – The radiation protection ALARA supervisor completed a brief for the upcoming under-vessel work. Besides the supervisor providing the brief, attendees were the three technicians who would work under-vessel and another technician that would remain located outside the drywell to monitor radiological conditions. This brief did not discuss the backup plan for shuttle tube removal from the bottom of the vessel.

2300 – Source range monitor B work completed. Work on intermediate range monitor C begins. Shortly afterward, technicians call instrumentation and control superintendent to inform that intermediate range monitor C required male threaded nose cone (like the ones used on source range monitor B), and requested guidance on removal of shuttle tube without the proper nose cone. Instrumentation and control superintendent then calls outage control center maintenance outage manager to request guidance on removing the shuttle tube from under-vessel. Outage control center maintenance outage manager directed instrumentation and control superintendent to proceed with removal from under-vessel. Instrumentation and control superintendent relayed this direction to the under-vessel technicians.

2400 – Instrumentation and control technicians call their superintendent again to confirm removal of the shuttle tube from under-vessel. The technicians express concern that removing the shuttle tube from under the vessel would require

bending the tube and would therefore be irreversible. The instrumentation and control superintendant requested and received confirmation from outage control center maintenance outage manager and then related that confirmation to the under-vessel technicians. Instrumentation and control technicians begin removing shuttle tube from under-vessel.

April 3, 2011 – (times approximated)

0000 – Outage control center maintenance outage manager informed rest of outage control center that shuttle tube would be pulled from below vessel. He stated that the tube was assumed to be titanium, and therefore, would not activate. However, this assumption was not verified and it turned out that the shuttle tube was actually stainless steel. Outage control center radiation protection representative challenged the assumption that titanium would not activate. During the discussion, the three technicians working under the vessel received dose rate alarms, immediately evacuated the under-vessel area and told radiation protection personnel in the area that dose rates had significantly increased.

0047 – The licensee entered their emergency procedure for elevated radiological conditions inside the primary containment under-vessel area and drywell access was restricted.

2.3 Immediate Actions Taken

Upon receiving the electronic dosimeter alarms, the workers immediately evacuated the drywell. The licensee immediately evacuated all personnel from the drywell, restricted access to the drywell, and entered Emergency Procedure 5.1RAD, "Building Radiation Trouble," Revision 15, due to unexpected elevated dose rates. The licensee implemented radiological emergency procedures which identified the source as the intermediate range monitor shuttle tube that was removed from the reactor pressure vessel by the workers. The licensee implemented a recovery plan to isolate the source of radiation and secure it in a shielded lead container. The recovery plan was executed by three radiation protection technicians who were knowledgeable of the radiological conditions. The plan included identifying the highest dose rates in the area, which was the tip of the shuttle tube, and quickly cutting the stainless steel shuttle tube with metal cutters and securing the approximately one foot piece of the shuttle tube. The remaining tube was also cut up into approximately one foot pieces and secured in the shielded container. The shielded container was then placed safely in the spent fuel pool.

3.0 Work Planning and Execution

3.1 Work Order Planning

a. Scope

The inspectors assessed the licensee's performance while planning and preparing the work package to replace source range monitor B and intermediate range monitor C. The inspectors conducted interviews to assess the knowledge level and qualifications of planners. The inspectors examined procedural guidance for work package creation to determine adequacy and completeness. The inspectors also evaluated the licensee's ability to appropriately characterize and compensate for the risk associated with the

maintenance activity. Interactions with other working groups, such as operations and radiation protection, were similarly reviewed. The inspectors also evaluated the licensee's review process to ensure that work packages are complete and accurate.

b. Findings

.1 Introduction. The inspectors identified a Green noncited violation of Technical Specification 5.4.1, for a failure to implement procedures described in Regulatory Guide 1.33, Appendix A. Specifically, the licensee failed to implement procedures that provide guidance on creating and reviewing clear, accurate work instructions. As a result, the work instructions could not have been completed as written.

Description. On April 3, 2011, three instrumentation and control technicians were performing Work Order 4741002, to remove intermediate range monitor C from the underside of the reactor vessel and prepare the dry tube assembly for later removal from above the reactor vessel. Work Order 4741002, Step 4, directed the technicians to remove the drive tube per Procedure 14.2.9, "SRM/IRM Detector and Drive Tube Removal, Installation, Testing, and SRM/IRM Troubleshooting," Revision 26. Step 5.8 of Procedure 14.2.9 directed the technicians to screw a nose cone onto the bottom of the dry tube, enclosing the shuttle tube within the dry tube. Work Order 4741002, Step 5, then directed the technicians to "remove shuttle tube." However, if Procedure 14.2.9 had been correctly followed, Step 5 of the work order could not have been performed because the shuttle tube would have been contained within the dry tube. Additionally, no procedural reference is given for shuttle tube removal. When the inspectors asked the work planner to clarify the intent of the unclear work instructions, he was unable to provide any clarification.

Procedure 0.40.4, "Planning," Revision 16, Attachment 1, included a checklist that was to be used to ensure that work instructions were clear and concise. The inspectors attempted to review this checklist since it was used to plan the work package. However the checklist had been discarded. Use of the Attachment 1 checklist failed to identify instructions that were not only unclear to the workers, but also to the work planner.

Additionally, Procedure 0.40.4, Step 5.2.10, required the work planner to ensure that all specialized tools required to perform the work are identified and available. The nose cone was not listed as a required part for work order execution and was not readily available. If the nose cone had been made available (as required by procedure), the technicians may not have attempted to execute an unclear instruction. This is evidenced by the technician's performance of Work Order 4741006, removal of source range monitor B, which contained the same unclear instructions. However, during this work, the technicians had a male-threaded nose cone, so no attempt was made to remove the shuttle tube from the bottom.

Another potential barrier to prevent the unclear work order instructions from reaching the field was provided in Procedure 0.40, "Work Control Program," Section 6.1, which directed an instrumentation and control shop walkdown of the work instructions in accordance with Procedure 0.40.4, Attachment 7. This attachment contained another checklist for verifying work instruction. Inspectors attempted to review this checklist to assess its performance; however this checklist was also discarded. The inspectors concluded that despite the licensee's assurance that the checklist was correctly utilized, use of the checklist during the shop walkdown failed to identify the unclear work instructions and lack of necessary parts.

Although each individual requirement, if correctly performed, may or may not have singularly prevented the confusing and incomplete work package from reaching final approval, together they provide defense-in-depth; a set of guidelines that are intended to provide multiple opportunities to detect and correct poor work instructions prior to field execution. The failure of all three of these steps allowed poor work instructions to be approved.

These unclear work instructions and lack of a needed part contributed to the decision to "remove shuttle tube" from the bottom, despite lack of adequate procedural guidance. As a result, three instrumentation and control technicians received an unexpected radiation dose.

In interviews with station personnel, the inspectors encountered indications of a widespread attitude among workers that failures to follow procedures were acceptable if they achieved the desired outcomes. In those interviews, the inspectors found no evidence that the licensee had effectively communicated their expectations regarding procedural compliance. Also, the licensee's root cause evaluation, documented as Condition Report CR-CNS-2011-03763, determined that one root cause of this finding was a work culture, supported by institutional reinforcement, that unacceptable behaviors are acceptable as long as the outcome is good.

Analysis. The performance deficiency is that the licensee did not follow Procedure 0.40, "Work Control Program," and Procedure 0.40.4, "Planning," when preparing Work Order 4741002. As a result, the work order could not be performed as written. This deficiency was reasonable for the licensee to foresee and prevent occurrence. The finding is more than minor because it is associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure the adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation, in that the finding resulted in three technicians receiving an unexpected radiation dose. The inspectors evaluated the significance of the finding using NRC Inspection Manual 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process," dated August 19, 2008. The inspectors determined that the finding is of very low safety significance (Green) because it is not a finding related to ALARA planning or work controls, it did not result in an overexposure, there was no substantial potential for overexposure, and the licensee's ability to assess dose was not compromised. The inspectors determined that the apparent cause of this finding was the licensee's failure to correct the attitude among workers that failures to follow procedures were acceptable if they achieved the desired outcomes. Therefore, the finding has a cross-cutting aspect in the work practices component of the human performance area because the licensee did not effectively communicate expectations regarding procedural compliance [H.4.(b)].

Enforcement. Technical Specification 5.4.1 requires the licensee to establish, implement, and maintain procedures described in Regulatory Guide 1.33, Appendix A. Appendix A, Section 9, requires, in part, that maintenance that can affect the performance of safety related equipment should be properly preplanned in accordance with written procedures appropriate to the circumstances. Licensee Procedures 0.40 and 0.40.4 are similar to those described in Section 9.

Contrary to the above, on April 3, 2011, the licensee did not correctly implement the above procedures by not properly preplanning maintenance in accordance with written

procedures appropriate to the circumstances. Specifically, despite the guidance outlined in Procedures 0.40 and 0.40.4, the licensee developed a work instruction that did not list the needed tools and could not be followed as written. As a result, three instrumentation and control technicians received an unexpected radiation dose. A site stand-down was held to discuss the lessons learned from the event. Because this was of very low safety significance and it was entered into the corrective action program as Condition Reports CR-CNS-2011-4431, CR-CNS-2011-4581, CR-CNS-2011-4582, CR-CNS-2011-4583, CR-CNS-2011-4584, and CR-CNS-2011-4585, this violation is being treated as a noncited violation, consistent with Section 2.3.2 of the Enforcement Policy: NCV 05000298/2011008-01, "Unclear Work Instructions."

.2 Introduction. The inspectors identified a Green noncited violation of Technical Specification 5.4.1, for a failure to implement procedures described in Regulatory Guide 1.33, Appendix A. Specifically, the licensee failed to implement procedures that provide guidance on recognizing risk associated with a maintenance activity and properly accounting for that risk.

Description. On April 3, 2011, three instrumentation and control technicians executed Work Order 4741002, intended to remove the intermediate range monitor C assembly from the underside of the reactor vessel. The work order then directed the dry tube assembly replacement. During this activity, the dry tube assembly should have been pulled out from above the reactor vessel, creating a hole under the vessel, so a "water seal cap" was to be installed under the reactor vessel to prevent reactor coolant from draining out. This water seal cap becomes the new reactor coolant system pressure boundary. Correct installation of this cap is critical, since any installation error could induce a reactor coolant leak under the vessel and create a potential to drain the reactor vessel.

The activities performed in Work Order 4741002 introduced a high level of risk to the safe operation of the plant. Procedure 0.40, "Work Control Program," Revision 75, Section 5.7, provides examples of when a work package should be characterized as a detailed (Level 1) work order. Because of the risk introduced, the procedure required that Work Order 4741002 be considered a detailed work order, requiring a peer review by both planning and engineering departments and including operational experience. However, it was incorrectly characterized as a simple (Level 2) work order, so no additional reviews were completed and site-specific operating experience was not included in the work package.

Additionally, Procedure 0.40.4, "Planning," Revision 16, Section 5.2.19, required the plant impact to be determined by using Attachment 3, which includes a checklist. The overall risk to the plant is then documented in the work package. The inspectors attempted to review this checklist to assess its performance, however the copy of the checklist had been discarded. The inspectors concluded that the checklist failed to correctly categorize the risk associated with the work activity. The resulting plant impact statement not only incorrectly stated that this work "does not introduce unusual hazards or risks" and "has no impact on the plant," but also incorrectly stated that the work could be performed in Mode 4 or 5. This work can only be performed in Mode 5.

As a result of the unrecognized risk, additional barriers to ensure a quality work package were bypassed. The resulting work package contained unclear work instructions that could not be performed as written, did not contain a complete listing of parts needed to

perform the activity, and did not contain appropriate operating experience. These deficiencies contributed to the decision to remove the shuttle tube from under the vessel, despite lack of actual procedural guidance. As a result, three instrumentation and control technicians received an unexpected radiation dose. A site stand-down was held to discuss the lessons learned from the event.

Analysis. The performance deficiency is that the licensee did not follow Procedure 0.40, "Work Control Program," and Procedure 0.40.4, "Planning," when preparing Work Order 4741002 to determine the risk associated with the maintenance activity. The resulting failure to recognize the associated risk led to the package being incorrectly characterized as a simple work order, rather than a detailed work order, and the work order was not given the appropriate level of attention or review. This deficiency was reasonable for the licensee to foresee and prevent occurrence. The finding is more than minor because it is associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure the adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation, in that the finding resulted in three technicians receiving an unexpected radiation dose. The inspectors evaluated the significance of the finding using NRC Inspection Manual 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process," dated August 19, 2008. The inspectors determined that the finding is of very low safety significance (Green) because it is not a finding related to ALARA planning or work controls, it did not result in an overexposure, there was no substantial potential for overexposure, and the licensee's ability to assess dose was not compromised. The inspectors determined that the apparent cause of this finding was the licensee's failure to ensure workers recognize the value of incorporating risk insights into plans for maintenance activities. Therefore, the finding has a cross-cutting aspect in the work control component of the human performance area because the licensee did not plan work activities by incorporating risk insights [H.3(a)].

Enforcement. Technical Specification 5.4.1 requires the licensee to establish, implement, and maintain procedures described in Regulatory Guide 1.33, Appendix A. Appendix A, Section 9 requires, in part, that maintenance that can affect the performance of safety related equipment should be properly preplanned in accordance with written procedures appropriate to the circumstances. Licensee Procedure 0.40 and Procedure 0.40.4 are similar to those described in Section 9. Contrary to the above, on April 3, 2011, the licensee did not correctly implement the above procedures. Specifically, despite the guidance contained in Procedures 0.40 and 0.40.4, the licensee developed a work instruction that failed to recognize the risk associated with the activity and failed to develop risk mitigation strategies. This activity had the potential to drain the reactor vessel. Because this was of very low safety significance and it was entered into the corrective action program as Condition Reports CR-CNS-2011-4435 and CR-CNS-2011-4436, this violation is being treated as a noncited violation, consistent with Section 2.3.2 of the Enforcement Policy: NCV 05000298/2011008-02, "Failure to Recognize Work Order Risk."

3.2 Job Preparation

a. Scope

The inspectors assessed the licensee's preparations to perform the work to replace source range monitor B and intermediate range monitor C. This included conducting interviews with all personnel present at the pre-job brief to determine the workers' level of understanding of the job to be performed, as well as determine the worker's procedural compliance. Procedural guidance was reviewed for adequacy and completeness. Interactions with other working groups, such as operations and radiation protection, were similarly reviewed. Operating experience was also reviewed to determine the licensee's efforts to incorporate and institutionalize the information.

b. Findings

Introduction. The inspectors identified a Green finding for a failure to implement human performance procedures. Specifically, the licensee failed to implement procedures that provided guidance on conducting pre-job briefs, preparing work in the field, and informing technicians on what to do when the workers encountered a problem. As a result, workers were uncertain how to proceed, especially when needed parts were not available.

Description. On April 3, 2011, instrumentation and control technicians prepared to perform Work Order 4741002 by conducting a pre-job brief. The brief was conducted by the lead technician, with two other technicians and the supervisor present. Neither technicians nor supervisor had previously performed this activity. The supervisor had "glanced at" the work package, but was not familiar with it. Procedure 0-HU-Tools, "Human Performance Tools," Revision 17, Attachment 8, provides guidance on how to conduct pre-job briefs. Attachment 8, the section entitled "How To Do It," lists seven steps for conducting the brief. Several of those steps were not adequately completed as follows:

- Step 1 expected the briefer to "have a thorough understanding of every aspect of the activity," however the lead technician conducting the pre-job brief was not sure which nose cones were needed, whether the correct nose cones were readily available, and how the activity would proceed if the correct nose cones could not be located. The pre-job brief was completed with these questions still unanswered. The technicians believed they would "figure it out" after the work began.

- Step 2 expected that the pre-job brief include "all individuals participating in the activity and anyone significantly impacted by the activity." The work activity affected instrumentation and control technicians, radiation protection personnel, and the outage control center staff. Additional work in the same package also affected a contractor work group. Representatives from those other work groups were not present at the instrumentation and control shop pre-job brief. A separate pre-job brief was held with radiation protection personnel, but the level of detail and focus of the discussion was different from that of the shop pre-job brief.

- Step 3 expected the licensee to review operation experience during pre-job briefs. One example of operating experience from another site was discussed,

but relevant site specific operating experience from 1993 and 1994 was omitted. The omitted operating experience described how workers received higher-than-expected doses when a shuttle tube was removed from under the vessel in 1993. Since the possibility of actually removing the shuttle tube from under the vessel was discussed during the pre-job, this operating experience may have provided a prompt to alert the technicians that shuttle tube removal from under the vessel would elevate dose level and potentially dissuade them from working outside the procedure.

- Steps 4 and 5 directed that Procedure 2.01.1, "Conduct of Infrequently Performed Tests or Evolutions," Revision 5, be used. However, this procedure was not used. Additionally, the pre-job brief checklist directed attention to potential error traps, such as time pressure and task unfamiliarity, but checklist identification of these traps failed to prevent an error from occurring.

Work began after the brief was complete. During performance of Work Order 4741002, the technicians determined that not all the needed parts were present, so a step in the procedure could not be performed. The technicians stopped work and spoke with the instrumentation and control supervision, who gave the workers verbal direction. This direction included marking the procedural step as a "discrepancy" and continuing work via an undocumented, unapproved "back-up" plan discussed at the pre-job brief.

In interviews with station personnel, the inspectors encountered indications of a widespread attitude among workers that failures to follow procedures were acceptable if they achieved the desired outcomes. In those interviews, the inspectors found no evidence that the licensee effectively communicated their expectation regarding procedural compliance. Also, as documented in Condition Report CR-CNS-2011-03763, the licensee's root cause evaluation determined that one root cause of this event was a work culture, supported by institutional reinforcement, that unacceptable behaviors are acceptable, as long as the outcome was good.

Analysis. The performance deficiency is that the licensee did not follow Procedure 0-HU-Tools while preparing for and executing Work Order 4741002. As a result, the technicians incorrectly continued work when the needed parts were not available, rather than stopping work. This deficiency was reasonable for the licensee to foresee and prevent occurrence. The finding is more than minor because it is associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure the adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation, in that the finding resulted in three technicians receiving an unexpected radiation dose. The inspectors evaluated the significance of the finding using NRC Inspection Manual 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process," dated August 19, 2008. The inspectors determined that the finding is of very low safety significance (Green) because it is not a finding related to ALARA planning or work controls, it did not result in an overexposure, there was no substantial potential for overexposure, and the licensee's ability to assess dose was not compromised. The inspectors determined that the apparent cause of this finding was the licensee's failure to promote the use of human performance tools to ensure job tasks were properly completed. Therefore, this finding has a cross-cutting aspect in the work practices component of the human performance area because the

licensee did not adequately communicate human error prevention techniques such that work activities are completed safely [H.4(a)].

Enforcement. This finding does not involve enforcement action because no regulatory requirement was violated: FIN 05000298/2011008-03,"Failure to Implement Human Performance Procedure."

3.3 Work Execution

a. Scope

The inspectors assessed the licensee's execution of the work to replace source range monitor B and intermediate range monitor C. This included reviewing the work order, procedures, and conducting interviews with all personnel present at the job site, as well as the decision-makers in the outage control center. The inspectors assessed the workers' and managers' level of understanding of the job activity and any contingency plans or abort criteria. The inspectors reviewed procedural guidance for adequacy and completeness, and assessed the licensee's in-field procedural compliance. Maintenance practices demonstrated by in-field workers were compared to the licensee's expectations for maintenance activities.

b. Findings

Introduction. The inspectors identified a Green noncited violation of Technical Specification 5.4.1, for a failure to comply with procedures described in Regulatory Guide 1.33, Appendix A. Specifically, the licensee failed to implement procedures and a work order instruction that required the work order to be returned to work planners and revised if the original work scope is changed or a problem is encountered.

Description. On April 3, 2011, three instrumentation and control technicians were implementing Work Order 4741002, to remove intermediate range monitor C from the underside of the reactor vessel and prepare the dry tube assembly for later removal from above the reactor vessel. Work Order 4741002, Step 4, directed the technicians to remove the drive tube per Procedure 14.2.9, "SRM/IRM Detector and Drive Tube Removal, Installation, Testing, and SRM/IRM Troubleshooting," Revision 26. Step 5.8 of Procedure 14.2.9 directed the technicians to install a male-threaded nose cone that is screwed onto the bottom of the dry tube, enclosing the shuttle tube within the dry tube. Without this nose cone, the shuttle tube would fall out the bottom of the dry tube and remain in the reactor vessel when the dry tube is removed from the top. While performing this task, the technicians determined that the nose cone was not available. The technicians discussed the inability to continue following the work instructions with their supervisor. A nonconservative decision was made to pull the shuttle tube out of the core from the bottom of the vessel rather than enclosing it in the dry tube assembly as originally directed by the work package. This nonconservative decision was based on unvalidated assumptions, such as shuttle tube material, expected dose rates, and instrumentation and control familiarity with the plan change. The technicians pulled the shuttle tube from the bottom and exposed a 3,226 rem per hour source. The technician's dosimetry alarmed and they exited the area. As a result, three instrumentation and control technicians received an unexpected radiation dose. A site stand-down was held to discuss the lessons learned from the event.

Work Order 4741002, Prerequisite 2, stated in part, that if during the performance of the work order, should problems arise, workers should stop work and return the work package to planning for revision before proceeding with work.

This guidance is congruent with two other site procedures governing procedural compliance. Site Procedure 0.40, "Work Control Program," Revision 75, Step 7.4.7, states that if work cannot be performed as written, the worker shall stop work and contact the supervisor, who assesses the type of change needed in accordance with Procedure 0.40.4, "Planning." Procedure 0.40.4, Revision 16, Step 5.4.1, required that a work order revision was required if the work scope changes. In this case, the work scope could not be completed as stated and the licensee made the decision to change the work scope by pulling the shuttle tube from the bottom, rather than remaining within the dry tube assembly. Additionally, Procedure 7.0.4, "Conduct of Maintenance," Revision 32, Step 10.2.3, also states that changes in intent of work activities performed should not be made without changes to the original controlling document (work order).

Despite similar procedural guidance located in different locations, the nonconservative decision was made to pull the shuttle tube from the bottom of the vessel, rather than revising the work package as procedurally directed.

Analysis. The performance deficiency is that the licensee did not follow Procedure 0.40, "Work Control Program," and Procedure 7.0.4, "Conduct of Maintenance," when Work Order 4741002 could not be performed as written. Work Order 4741002 also included instructions that required the work package to be sent back to planning to be revised, if problems arose during work order performance. This deficiency was reasonable for the licensee to foresee and prevent occurrence. The finding is more than minor because it is associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure the adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation, in that the finding resulted in three technicians receiving an unexpected radiation dose. The inspectors evaluated the significance of the finding using NRC Inspection Manual 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process," dated August 19, 2008. The inspectors determined that the finding is of very low safety significance (Green) because it is not a finding related to ALARA planning or work controls, it did not result in an overexposure, there was no substantial potential for overexposure, and the licensee's ability to assess dose was not compromised.

The inspectors determined that the apparent cause of this finding was the licensee's failure to ensure that risk-significant changes to the work orders were made only through established processes. Therefore, this finding has a cross-cutting aspect in the decision making component of the human performance area because the licensee did not use a systematic process to make the risk-significant decision to deviate from work instructions [H.1(b)].

Enforcement. Technical Specification 5.4.1 requires the licensee to establish, implement, and maintain procedures described in Regulatory Guide 1.33, Appendix A. Appendix A, Section 9 requires, in part, that maintenance that can affect the performance of safety related equipment should be properly preplanned in accordance with written procedures appropriate to the circumstances. Licensee Procedure 0.40, Procedure 7.0.4, and maintenance Work Order 4741002 are similar to those described

in Section 9, in that, they required work orders that could not be performed as written to be returned to planning for revision. Contrary to the above, on April 3, 2011, the licensee did not correctly implement the above procedures. Specifically, the licensee failed to return the work package to planning for a revision when the work order could not be performed as written and when workers changed the intended work scope. As a result, three instrumentation and control technicians received an unexpected radiation dose. A site stand-down was held to discuss the lessons learned from the event. Because this was of very low safety significance and it was entered into the corrective action program as Condition Reports CR-CNS-2011-4428, CR-CNS-2011-4581, CR-CNS-2011-4582, CR-CNS-2011-4583, CR-CNS-2011-4585, CR-CNS-2011-4591, and CR-CNS-2011-4592, this violation is being treated as a noncited violation, consistent with Section 2.3.2 of the Enforcement Policy: NCV 05000298/2011008-04, "Failure to Revise Unclear Work Instructions."

4.0 Radiation Protection Performance

4.1 ALARA Planning

a. Scope

The inspectors assessed the licensee's performance while developing the ALARA work package to replace source range monitor B and intermediate range monitor C. The inspectors conducted interviews to assess the knowledge level and qualifications of ALARA planners. The inspectors examined the adequacy and completeness of procedural guidance for developing ALARA work packages. Interactions between radiation protection, maintenance, and operations were reviewed to determine if ALARA planning was performed with appropriate coordination and communication. The inspectors also evaluated the licensee's review process to ensure that work packages are complete and accurate.

b. Findings

No findings were identified. The inspectors determined that the ALARA planning for the job was completed adequately for removing the source range monitor and intermediate range monitor through the top of the reactor vessel. However, since the workers changed plans during the execution of the plan and did not seek a revision to the ALARA plan, a finding was identified in the area of work execution (see Section 3.3).

4.2 Radiation Work Permit Adequacy

a. Scope

The inspectors assessed the licensee's performance with respect to maintaining occupational individual and collective radiation exposures ALARA. The inspectors used the requirements in 10 CFR Part 20, the technical specifications, and the licensee's procedures required by technical specifications as criteria for determining compliance. The inspectors reviewed the licensee's previous experience with similar jobs, historical information regarding doses received, and historical and current survey data used to establish the radiological conditions of the radiation work permit including dose and dose rate alarm setpoints.

b. Findings

No findings were identified. The inspectors determined that the radiation work permit was adequate for the original plan to remove the source range monitor and intermediate range monitor through the top of the reactor vessel. However, since the workers changed plans and did not seek a revision to the radiation work permit, a finding was identified in the area of work execution (see Section 3.3).

4.3 ALARA Briefing

a. Scope

The inspectors assessed the licensee's ALARA briefing of workers preparing to enter the drywell to perform the work to replace source range monitor B and intermediate range monitor C. The inspection included conducting interviews with personnel in attendance at the pre-job ALARA briefing to determine the workers' level of understanding of the job to be performed, as well as, determine if the workers were appropriately briefed per high radiation area technical specifications and licensee procedures. The inspectors reviewed the licensee's radiation work permit and high radiation area briefing sheets to determine if the licensee had adequately assessed the scope of the job to be performed. The inspectors reviewed the licensee's implementation of the requirements of 10 CFR Parts 19 and 20.

b. Findings

Introduction. The inspectors identified a Green noncited violation of Technical Specification 5.7.2, for the failure to adequately brief radiation workers entering a locked high radiation area. Specifically, on April 2, 2011, the radiation protection pre-job briefing failed to discuss radiation dose rates that may be encountered when pulling the intermediate range monitor shuttle tube from under the reactor pressure vessel and did not identify any scope change or breach of the under-vessel nuclear instrument system.

Description. On April 2, 2011, three instrumentation and control technicians were provided with an ALARA pre-job briefing by radiation protection personnel for entry into a high radiation area to perform work on special (radiation) Work Permit 2011-422. The job scope included removing intermediate range monitor C shuttle tube from the bottom of the reactor pressure vessel. The shuttle tube was highly radioactive because it had been in the reactor core. The ALARA briefing provided information to the workers about general area dose rates and electronic dosimetry alarm setpoints. However, the ALARA briefing did not provide dose rates that would be encountered when removing the shuttle tube because the radiation protection personnel providing the ALARA briefing did not have an understanding of the full scope of the job and did not ask any questions to clarify or confirm the full scope of the job. Therefore, the ALARA briefing did not make workers knowledgeable about the dose rates they would encounter during the job. As a result, when the workers removed the shuttle tube from the bottom of the vessel, radiation levels of 3,226 rem per hour on contact with the tip of the shuttle tube and 39 rem per hour at 30 centimeters, as measured later by an AMP-200 detector, were encountered. The workers' electronic dosimetry alarmed and they immediately left the area and contacted radiation protection personnel.

The inspectors interviewed radiation protection personnel, the three workers, and other site personnel involved in the event. The inspectors reviewed the special work permit

requirements, surveys used during the ALARA briefing, and the radiation protection briefing form used for the ALARA briefing. The inspectors determined that the ALARA briefing form indicated no system breach was to be performed during this job, however, that was not true because the workers planned to breach the incore nuclear instrument system. The ALARA briefing did not cover a system breach of the nuclear instrument system, even though it was originally planned. The ALARA briefer lacked a questioning attitude with respect to gaining an understanding of the full scope of the work activity that the technicians were about to perform. The briefer did not question the special work permit dose setpoints that were set at 300 and 600 millirem/hr even though the ALARA briefing form indicated dose rates in the area of 80-120 millirem/hr. Additionally, there was no discussion or review of relevant Cooper Nuclear Station operating experience, which would have identified that high dose rates would be encountered during the performance of this work activity.

The inspectors determined that the pre-job ALARA briefing was inadequate because the workers were not made knowledgeable of the dose rates in a high radiation area while performing the activities they had planned as required by Technical Specification 5.7.2. The inspectors also determined that the licensee failed to appropriately communicate, coordinate, and cooperate with each other during the ALARA pre-job briefing and to keep personnel apprised of plant conditions that may affect work activities to ensure radiological safety was maintained.

Analysis. The failure to perform an adequate ALARA briefing to make workers knowledgeable of the dose rates in the work area is a performance deficiency. The finding is more than minor because it is associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure the adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation, in that the finding resulted in three technicians receiving an unexpected radiation dose. The inspectors evaluated the significance of the finding using NRC Inspection Manual 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process," dated August 19, 2008. The inspectors determined that the finding is of very low safety significance (Green) because it is a finding related to ALARA planning or work controls, but the licensee's three year rolling average for collective dose is less than 240 person-rem. The inspectors determined that the apparent cause of this finding was that the licensee had not encouraged interdepartmental communication and coordination between workers to ensure that workers were properly prepared to begin work activities. Therefore, this finding has a cross-cutting aspect in the work control component of the human performance area because the licensee did not incorporate actions to address the need for work groups to communicate, coordinate, and cooperate with each other during activities in which interdepartmental coordination is necessary to assure human performance, in that the licensee did not address the need for work groups to communicate, coordinate, and cooperate with each other during the ALARA pre-job briefing, which was an activity in which interdepartmental coordination is necessary to assure human performance [H.3(b)].

Enforcement. Technical Specification 5.7.2 states that, in addition to the requirements of Specification 5.7.1, entry into high radiation areas accessible to personnel with dose rates such that a major portion of the whole body could receive in 1 hour a deep dose equivalent in excess of 1000 millirem shall be provided with locked doors except during periods of access by personnel under an approved special work permit which shall

specify the dose rates in the area. Technical Specification 5.7.1(b) states, in part, that individuals permitted to enter high radiation areas shall be provided with a monitoring device that continuously integrates the radiation dose and alarms when a preset dose is received. Entry into such areas may be made after the dose rates in the area have been established and personnel have been made knowledgeable of them. Contrary to this requirement, on April 2, 2011, the licensee failed to adequately brief the dose rates in the immediate work area and make workers knowledgeable of the dose rates within the high radiation area before allowing entry into the area. Because this violation was of very low safety significance and it was entered into the corrective action program as Condition Report CR-CNS-2011-04441, this violation is being treated as a noncited violation, consistent with Section 2.3.2 of the Enforcement Policy:
NCV 05000298/2011008-05, "Failure to Perform an Adequate High Radiation Area Briefing."

4.4 Job Coverage

a. Scope

The inspectors reviewed the licensee's actions with respect to providing radiation protection coverage of workers entering a locked high radiation area to perform work during the shuttle tube event. The inspectors used the requirements in 10 CFR Part 20, the technical specifications, and the licensee's procedures required by technical specifications as criteria for determining compliance. During the inspection, the inspectors interviewed the radiation protection manager, radiation protection supervisors, radiation protection technicians, and radiation workers. The inspectors performed tours of the plant to understand scope of the job during the shuttle tube event. The inspectors reviewed radiological hazards control and work coverage, including the adequacy of surveys, radiation work permits, radiation protection job coverage, and contamination controls. The inspectors reviewed radiation worker and radiation protection technician performance during the shuttle tube event.

b. Findings

Introduction. The inspectors identified a Green noncited violation of Technical Specification 5.4.1.a for the failure to follow radiation protection Procedure 9.EN-RP-141, "Job Coverage," Revision 8. Specifically, during the nightshift on April 2, 2011, radiation protection personnel were monitoring workers pulling the intermediate range monitor shuttle tube from under the reactor pressure vessel and failed to adequately implement several requirements of the job coverage procedure which resulted in workers being exposed to unexpected high dose rates up to 39 rem per hour at 30 centimeters from the shuttle tube.

Description. On April 2, 2011, three workers entered the drywell, which was a posted locked high radiation area, to perform work to remove the intermediate range monitor C shuttle tube. Prior to entering the drywell, the workers donned protective clothing and respiratory protection (powered air purifying respirators). The radiation protection technicians at the drywell entry point assisted the workers with donning the respirators and were responsible for monitoring the workers radiation dose. For entries into locked high radiation areas, radiation protection technicians were required to monitor work activities remotely or at the job site. For this activity, the licensee determined that remote monitoring using teledosimetry (radiation dose transmitted from electronic

dosimeters to a remote monitoring station) and continuous communications (via a site cell phone) was sufficient to provide adequate radiation protection job coverage for the workers. The required actions for remote monitoring job coverage activities in a locked high radiation area prior to, and during, the performance of the work were described in Station Procedure 9.EN-RP-141, "Job Coverage," Revision 8.

The inspectors interviewed station personnel, toured the drywell entry point, and reviewed station procedures. The inspectors identified that radiation protection personnel had failed to adequately implement several job coverage procedural requirements, which either resulted in, or contributed to, the workers being exposed to higher than expected dose rates. The failures are described below:

1. The remote-monitoring technician did not attend the ALARA pre-job briefing for the work. Attachment 2, Section 2, "Responsibilities," Procedure 9.EN-RP-141, states that the radiation protection technician providing job coverage is responsible for attending the pre-job briefing. This failure resulted in the remote monitoring technician not having a full understanding of the work scope, and therefore, the remote monitoring technician was not able to identify when the scope changed. The remote monitoring technician believed that the work scope was limited to an inspection activity only, and not a maintenance activity to remove the intermediate range monitor C shuttle tube from beneath the reactor pressure vessel.

2. Radiation protection technicians providing job coverage failed to establish a method of communication. For this activity, it was decided that site cell phones would be used to communicate with the workers. Step 2.13 of Procedure 9.EN-RP-141 required that when using site cell phones as a communication device during continuous job coverage, it is required to have the keypad locked. Locking the phone ensured that communication from radiation protection to the workers was maintained during remote job coverage activities. (Step 2.13 was added to the procedure as a corrective action to a 2009 NRC violation because the site cell phone used during job coverage activities in 2009 had been inadvertently turned off and communication with workers was lost. That issue was documented in NRC Inspection Report 05000298/2009005.) However, the procedure did not make clear whose responsibility it was for locking the cell phone. When the inspectors interviewed station personnel to determine whose responsibility it was to lock the cell phone keypad, the inspectors received mixed answers, with some personnel stating it was the user's responsibility, others stated it was radiation protection technician's responsibility, while others stated it was worker's responsibility to lock the keypad but radiation protection personnel had to verify that the cell phone keypad was locked. The inspectors determined this lack of clarity about whose responsibility it was to have the phone locked contributed to the failure to ensure the phone was locked and stayed locked except when needed to establish communications with radiation protection.

3. The remote monitoring technician failed to review the applicable special (radiation) work permit as required by Step 5.5.1 of Procedure 9.EN-RP-141. This requirement ensures that the remote monitoring technician becomes knowledgeable of the work scope, such that if the scope changes the remote monitoring technician can take the appropriate actions when necessary. For this

event, the appropriate action would have been to stop the job, have the workers leave the work site, and prepare a revised radiation work permit.

4. The remote monitoring technician providing job coverage failed to communicate with workers to inform the workers of the radiological hazards associated with the nuclear instrument system, potential changes that would occur during the course of activities, understand the details of the work activity, and in particular any job steps that could impact radiological conditions as required by Step 5.5.4.2 of Procedure 9.EN-RP-141. The remote monitoring technician did not discuss the details of the work activity with the workers, and therefore, was not able to communicate the hazards that were associated with the work activity. The remote monitoring technician believed the workers were only going to perform an inspection under the reactor pressure vessel. The remote monitoring technician assumed that the ALARA pre-job briefing covered all radiological aspects of the work activity and did not believe the work activity would breach any systems or remove any parts. This assumption was not verified or validated.

5. Step 6.4.5 of Procedure 9.EN-RP-141 required that communication devices are verified operational between the remote monitoring station and the work location. Neither the workers nor the remote monitoring technician attempted to make contact with each other during the work activity.

6. Workers used the dedicated radiation protection cell phone to contact the outage control center to discuss the work activity with maintenance personnel. The remote monitoring technician could view the workers on the video monitor and see that the site cell phone designated for radiation protection coverage was in use and was not locked in accordance with Step 2.13 of the procedure. While the site cell phone is in use, it cannot be called. There is no call waiting. There is only a busy signal. Step 6.4.7 of Procedure 9.EN-RP-141 required that if communication is lost then it should be re-established in accordance with the procedure, or work activities suspended and personnel cleared from the area. No attempt was made to perform these requirements while communication was lost. In addition, the inspectors identified that the licensee's dayshift remote monitoring technicians used radios for communications and nightshift used cell phones. This inconsistency between dayshift and nightshift contributed to the loss of communications during this activity. The licensee corrected this discrepancy by requiring all remote monitoring technicians to use radios for continuous coverage communications.

7. Workers lowered the shuttle tube to the floor of the drywell prior to receiving permission to pull it all the way out of the reactor vessel. Step 5.5.4.2 of Procedure 9.EN-RP-141 required the remote monitoring technician to "monitor the work location to determine if new sources of exposure are being generated (e.g., trash or parts removed from the system)." The shuttle tube is a part of the nuclear instrument system and was beyond the scope of what the remote monitoring technician believed to be the work activity (inspection only). Video monitoring showed the part being lowered to the floor at which point the technician should have called the workers and told them to stop the activity.

8. The remote monitoring technician failed to exercise the stop work authority. Step 7.1 of Procedure 9.EN-RP-141 stated that radiation protection technicians

have both the responsibility and authority to stop work if there is a change in work scope or the continuance of work would result in a violation of good radiological work practices, or a violation of radiological work permit or special work permit requirements. When the workers changed scope during the performance of the work activity from what was understood by the remote monitoring technician, the work was required to be stopped.

The work was not stopped when the shuttle tube was initially pulled from the reactor vessel. Therefore, the workers under the vessel pulled the entire 27-foot-long shuttle tube out of the reactor vessel, and exposed themselves to the highly radioactive end of the shuttle tube. The workers' electronic dosimeters alarmed on high dose rate. The workers immediately left the area under the vessel and informed a radiation protection technician in the area that the dose rates had significantly increased. The licensee entered their emergency procedures for unexpected radiation levels in the building, cleared the drywell, and restricted access until the source of the radiation was identified.

The licensee's immediate corrective actions were to restrict access to the drywell, ensure that further work activities in the drywell had been reviewed and approved by the radiation protection supervision, and pursue activities to recover the drywell area under the reactor vessel by securing the shuttle tube.

During the recovery phase of the activity, radiation protection personnel measured contact radiation dose rates as high as 3,226 rem per hour, and 39 rem per hour at 30 centimeters from the shuttle tube. Radiation protection technicians recovered the drywell by placing the highly radioactive portion of the shuttle tube in a shielded container.

While interviewing personnel involved in this event, the inspectors encountered no indication that workers had used human error prevention techniques to ensure that they followed procedures.

Analysis. The failure to follow radiation protection job coverage procedures is a performance deficiency. The finding is more than minor because it could be viewed as, both, a precursor to a significant event, and if left uncorrected, could have led to a more safety significant concern. It is also associated with the human performance attribute of the Occupational Radiation Safety Cornerstone and affected the cornerstone objective to ensure the adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation because it resulted in workers receiving higher than expected doses. The inspectors evaluated the significance of the finding using NRC Inspection Manual 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process," dated August 19, 2008. The inspectors determined that the finding is of very low safety significance (Green) because the finding did not involve ALARA planning and work controls, did not result in an overexposure, did not involve a substantial potential for overexposure, and did not compromise the licensee's ability to assess dose. Additionally, the inspectors determined that the apparent cause of this finding was the licensee's failure to encourage workers to use human error prevention techniques to ensure that they followed procedures. Therefore, this finding has a crosscutting aspect in the work practices component of the human performance area because the licensee failed to use human error prevention techniques such as self-checking and peer-checking to ensure that job coverage procedures were followed [H.4(a)].

Enforcement. Technical Specifications 5.4.1 states in part, that written procedures shall be established, implemented, and maintained covering the applicable procedures recommended in Regulatory Guide 1.33, Revision 2, Appendix A, February 1978. Regulatory Guide 1.33, Section 7, required radiation protection procedures, including access control to radiation areas. Licensee Procedure 9.EN-RP-141, "Job Coverage," Revision 8, in part, required the licensee to implement the following job coverage activities :

(1) (Step 2.13) when site cell phones are used as a communication device during continuous job coverage, the keypad must be locked,

(2) (Step 3.4) communicate with workers to tell them about radiological hazards associated with the systems to be worked and potential changes that would occur during the course of activities, and understand the details of the work activity to be performed and job steps that could impact radiological conditions or result in personnel contaminations,

(3) (Step 5.5.1) upon assignment, review the applicable special work permit to determine the scope of work to be performed,

(4) (Step 5.5.4.2) monitor the work location to determine if new sources of exposure are being generated (e.g., parts removed from the system),

(5) (Step 6.4.5) verify communication devices operate between the remote monitoring technician station and the work location,

(6) (Step 6.4.7) if continuous coverage by remote monitoring is lost, then either reestablish continuous job coverage by other means or suspend work activities and clear personnel from the work area,

(7) (Step 7.1) stop work if there is a change in work scope or if the initiation of work or the continuance of work would result in a violation of good radiological work practices or a violation of radiation work permit/special work permit requirements, and

(8) (Attachment 2, Section 2 responsibilities, Step 2.4) attend the pre-job briefing.

Contrary to the above, on April 3, 2011, the licensee failed to:

(1) lock the cell phone keypad,

(2) inform the workers of radiological hazards associated with the nuclear instrument system,

(3) review the special work permit,

(4) monitor the work location to determine if new sources of exposure are being generated,

(5) verify communication devices operation between the remote monitoring technician and the work location,

(6) suspend work activities and clear personnel from the area when communication was lost,

(7) stop work when there was a change in work scope or the work would result in a violation of the radiation work permit requirements, and

(8) attend the pre-job briefing.

Because this finding is of very low safety significance and has been entered into the licensee's corrective action program as Condition Reports CR-CNS-2011-04442, CR-CNS-2011-04255, CR-CNS-2011-04595, CR-CNS-2011 -05443, CR-CNS-2011-05444, CR-CNS-2011-05446, CR-CNS-2011-05447, and CR-CNS-2011-05448, this violation is being treated as a noncited violation consistent with Section 2.3.2 of the NRC Enforcement Policy: NCV 05000298/2011008-06, "Failure to Follow Radiation Protection Job Coverage Procedures."

4.5 Dose and Dose Rate Assessment

a. Scope

The NRC performed an independent assessment of the dose and dose rate information using time motion studies to identify source of radiation, the exposure time, and the distance between the source and the workers tissue. The source of the radiation was the activated tip of the intermediate range monitor B shuttle tube. It was activated by the nuclear reactor core because it is composed of stainless steel exposed to neutrons during the operating cycle of the power reactor. Although the shuttle tube is in its retracted position during the cycle and is only inserted into the core during startup and shutdown operations, the end of the tube still becomes radioactive from long-term exposure to neutrons. Approximately, the top one inch of the tube is activated significantly more than the rest of the tube because of its retracted position, which is about 24 inches below the bottom core plate. The NRC performed an independent assessment of the skin dose to the hand of the worker who removed the shuttle tube from the reactor pressure vessel. This assessment was performed by the NRC's senior advisor for health physics using a software program called Monte Carlo N-particle. Dose rate data measured by the licensee during the recovery phase of event was entered into Monte Carlo N-particle. The data included AMP-200 Geiger Mueller detector and optically stimulated luminescent dosimeters which are specifically designed to measure shallow dose equivalent to human tissue. The AMP-200 data included 3,226 rem per hour on contact and 39 rem per hour at 30 centimeters. The optically stimulated luminescent data included 0.338 rem per second at one inch from the source. Based on time motion studies conducted later with workers, the individual handling the shuttle tube grasped the end of the shuttle tube for about 1.7 seconds.

Based on the time motion study that was reviewed by the inspectors and the independent Monte Carlo N-particle calculation performed by the NRC, the estimated skin dose to the hand of the worker who grasped the source was 2.9 rem. This dose is well below the regulatory limit of 50 rem. The licensee employed a certified health physicist to perform the dose calculation. The certified health physicist used manual calculations and a combination of computer codes to determine the skin dose. The licensee's estimated skin dose was 3.1 rem. Although the licensee used a different methodology than the NRC, the estimated skin doses are in relative agreement and differ by only 8 percent. Both values are significantly below regulatory limits and

therefore warrant no further analysis. The whole body dose assigned to the individual was 0.040 rem based on the electronic dosimeter readings and the time motion studies. The whole body dose is also below the annual regulatory limit of 5.0 rem.

b. Findings

No findings were identified.

5.0 Review of Previous Activity Performance

a. Scope

The inspectors reviewed previous intermediate range monitor and source range monitor removal activities. The inspectors assessed the adequacy of prior work packages and the execution of those work orders. Previous condition reports and past operating experience were reviewed for lessons learned. The inspectors compared the previous work orders to Work Order 4741002, to determine if this method (pulling the shuttle tube from the bottom) had been used in the past.

b. Findings

No findings were identified. Operating experience showed that a shuttle tube had previously been pulled from the bottom of the vessel, however this was a necessary action resulting from a stuck detector. In this instance, the licensee also experienced elevated radiation levels. The normal (proceduralized) method for replacing the tubing assembly was to remove the assembly from the top of the core.

6.0 Review of Causal Determination and Corrective Actions

a. Scope

The inspectors reviewed the preliminary root cause evaluation report and corrective actions identified to prevent recurrence of the root causes. The inspectors interviewed members of the licensee's root cause team and licensee management. At the end of the inspection period, the inspectors did not have the opportunity to review the final version of the root cause evaluation because the final report had not been completed and reviewed by licensee management.

b. Findings

No findings were identified. Because the final root cause report had not been completed at the time of this report, the inspectors were unable to evaluate its adequacy against the licensee's corrective action program procedures. Therefore, the final root cause report will be subject to inspection at a future date. Notwithstanding the issuance of the final root cause evaluation report, the inspectors noted that the licensee's preliminary root causes were consistent with the findings identified in this report. The licensee's long term corrective actions are still in the process of being developed, however, interim actions have been taken to prevent recurrence of this event. These actions include work order process procedure revisions to include identification of materials required to perform maintenance, implementing a work order quality review panel, revising work order risk assessment procedures, revising radiation protection briefing forms to ensure full extent of job scope is discussed at the ALARA briefing, reinforcing requirement for

radiation protection to attend all locked high radiation area briefings, and developing specific expectations for supervisors to ensure procedure compliance is mandatory.

4OA6 **MEETINGS**

On April 15, 2011, the team presented the preliminary results of this inspection at the end of the onsite week to Mr. D. Willis, General Manager Plant Operations, and other members of the licensee staff who acknowledged the findings. The team returned all proprietary information reviewed during the inspection prior to leaving the site.

On May 3, 2011, the team presented the final results of the inspection to Mr. A. Zaremba, Director of Nuclear Safety Assurance, and other members of the licensee staff via telephonic exit. The team obtained permission from the licensee to use the diagrams and photographs in this report.

On June 9, 2011, the team re-exited and presented revised results of the inspection to Mr. A. Zaremba, Director of Nuclear Safety Assurance, and other members of the licensee staff via telephonic exit.

ATTACHMENT 1: SUPPLEMENTAL INFORMATION
ATTACHMENT 2: SPECIAL INSPECTION CHARTER
ATTACHMENT 3: PICTURES AND DIAGRAMS

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

J. Bednar, Supervisor, Radiation Protection
J. Corey, Manager, Radiation Protection
E. McCutchen, Senior Licensing Engineer, Licensing
H. A. Hawkins, Superintendent, Instrumentation and Control
D. Willis, Plant Manager
A. Zaremba, Director of Nuclear Safety Assurance

NRC Personnel

M. Chambers, Resident Inspector
B. Hagar, Senior Project Engineer
J. Josey, Senior Resident Inspector
R. Pedersen, Senior Health Physicist
S. Sherbini, Senior Level Advisor for Health Physics

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened and Closed

050000298/2011008-01	NCV	Unclear Work Instructions (Section 3.1)
050000298/2011008-02	NCV	Failure to Recognize Work Order Risk (Section 3.1)
050000298/2011008-03	FIN	Failure to Implement Human Performance Procedure (Section 3.2)
050000298/2011008-04	NCV	Failure to Revise Unclear Work Instructions (Section 3.3)
050000298/2011008-05	NCV	Failure to Perform an Adequate High Radiation Area Briefing (Section 4.3)
050000298/2011008-06	NCV	Failure to Follow Radiation Protection Job Coverage Procedures (Section 4.4)

DOCUMENTS REVIEWED

Section 4OA3: Event Follow-up

CONDITION REPORTS

94-1262	NCR 93-045		
CR-CNS-2011-3769	CR-CNS-2011-4584	CR-CNS-2011-4588	CR-CNS-2011-3763
CR-CNS-2011-4255	CR-CNS-2011-4256	CR-CNS-2011-4258	CR-CNS-2011-4317
CR-CNS-2011-4428	CR-CNS-2011-4431	CR-CNS-2011-4432	CR-CNS-2011-4436
CR-CNS-2011-4429	CR-CNS-2011-4430	CR-CNS-2011-4438	CR-CNS-2011-4439
CR-CNS-2011-4440	CR-CNS-2011-4441	CR-CNS-2011-4442	CR-CNS-2011-4583
CR-CNS-2011-4581	CR-CNS-2011-4435	CR-CNS-2011-4433	CR-CNS-2011-4582
CR-CNS-2011-4591	CR-CNS-2011-4585	CR-CNS-2011-4586	CR-CNS-2011-3890
CR-CNS-2011-4592	CR-CNS-2011-4583	CR-CNS-2011-4587	CR-CNS-2011-4258
CR-CNS-2011-4593	CR-CNS-2011-4594	CR-CNS-2011-4595	CR-CNS-2011-4596
CR-CNS-2011-4597	CR-CNS-2011-4598	CR-CNS-2011-4599	CR-CNS-2011-4600
CR-CNS-2011-4601	CR-CNS-2011-5443	CR-CNS-2011-5444	CR-CNS-2011-5446
CR-CNS-2011-5447	CR-CNS-2011-5448	CR-CNS-2011-5450	

WORK ORDERS

4741009	4741002	4741006	4491177

RADIATION/SPECIAL WORK PERMITS

2009-422	2011-422	2011-465

PROCEDURES/DOCUMENTS

NUMBER	TITLE	REVISION
14.2.19	SRM/IRM Detector and Drive Tube Removal, Installation, Testing, and SRM/IRM Troubleshooting	26
14.2.19	SRM/IRM Detector and Drive Tube Removal, Installation, Testing, and SRM/IRM Troubleshooting	27
0.40	Work Control Program	75

0.40.4	Planning	16
0.1	Procedure Use and Adherence	36
7.0.4	Conduct of Maintenance	32
0-HU-TOOLS	Human Performance Tools	17
2.0.1.1	Conduct of Infrequently Performed Tests and Evolutions	5
10.29	LPRM and SRM/IRM Dry Tube Removal and Installation	29
IAC722-00-00, Fig. 12	Detector Drive Unit	0
IAC722-00-00, Fig. 9	Source Range and Intermediate Range Detector Drive	0
9.EN-RP-141	Job Coverage	8
9.ALARA.4	Radiation Work Permits	14
9.ALARA.5	ALARA Planning and Controls	21
5.1RAD	Building Radiation Trouble	15

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
612 EAST LAMAR BLVD, SUITE 400
ARLINGTON, TEXAS 76011-4125

April 7, 2011

MEMORANDUM TO: Dean Overland, Resident Inspector
Projects Branch E
Division of Reactor Projects

Binesh Tharakan, Resident Inspector
Projects Branch A
Division of Reactor Projects

FROM: Kriss Kennedy, Director */RA/*
Division of Reactor Projects

SUBJECT: SPECIAL INSPECTION CHARTER TO EVALUATE UNEXPECTED DOSES TO WORKERS AT COOPER NUCLEAR STATION

A Special Inspection Team is being chartered in response to a work activity that resulted in unexpected doses to workers at the Cooper Nuclear Station on April 3, 2011. Dean Overland is designated as the Special Inspection Team Lead with respect to work-control issues. Binesh Tharakan is designated as the Special Inspection Team Lead with respect to radiological issues.

A. Basis

On April 3, 2011, while licensee workers were preparing to remove the Intermediate Range Monitor-C (IRM-C) drive mechanism shuttle tube from the top of the reactor vessel, they discovered they did not have access to a waterproof nose cone that was to be attached to the lower end of the tube prior to removal.

When the workers reported this issue to the Outage Control Center (OCC), the OCC staff reportedly either instructed or gave permission to the workers to remove the shuttle tube from the bottom of the reactor vessel, instead of from the top as originally planned. The inspectors understand that the licensee did not modify either the associated work order or the corresponding Radiation Work Permit (RWP) to reflect this change.

As the workers removed the tube from the bottom of the vessel, the three workers under the vessel and one worker at the access point received dose-rate alarms. The workers then set the tip of the tube on the floor at the 888' elevation and exited the area. The workers' dosimeters reportedly measured dose rates of 1.35 rem per hour, 14.3 rem per hour, and 763 millirem/hr.

Surveys taken later found that the tip of the tube measured 3226 rem/hr on contact and 39 rem/hr at 30 cm, and that the general area dose rate was 4.6 rem/hr at waist level, increasing to 8.6 rem/hr at waist level near the tube.

B. Scope

The inspection is expected to perform data gathering and fact-finding in order to address the following:

1. Develop a sequence of events leading up to the event, actions taken upon receipt of dose rate alarms, and actions taken to reduce the dose rates following the event.
2. Develop a timeline and assess the decision-making process used by licensee personnel to deviate from the planned method to remove intermediate range monitor “C”.
3. Assess licensee compliance with procedures and work orders in accomplishing the evolution.
4. Compare and contrast performance of this activity on April 3, 2011 to the performance of similar activities during the current outage.
5. Review history of the licensee’s conduct of this evolution to determine if they have used this method of removal prior to April 3, 2011.
6. Characterize the dose rates during the event and the dose received by involved personnel.
7. Assess as low as reasonably achievable (ALARA) planning for the evolution.
8. Assess adequacy of the radiation work permit and pre-job briefing for this activity.
9. Review any preliminary cause determination the licensee has completed and assess adequacy of short term corrective actions.
10. Collect data necessary to support completion of the significance determination process.

C. Guidance

Inspection Procedure 93812, “Special Inspection,” provides additional guidance to be used by the Special Inspection Team. Your duties will be as described in Inspection Procedure 93812. The inspection should emphasize fact-finding in its review of the circumstances surrounding the events. Safety concerns identified that are not directly related to the event should be reported to the Region IV office for appropriate action.

The team will report to the site, conduct an entrance, and begin inspection no later than April 11, 2011. While onsite, you will provide daily status briefings to Region IV management, who will coordinate with the Office of Nuclear Reactor Regulation to ensure that all other parties are kept informed. Depending on the outcome of the inspection, inspection results will be documented in U. S. Nuclear Regulatory Commission (NRC) Special Inspection Report No. 05000298/2011008. This report will be issued within 45 days of the completion of the inspection.

This Charter may be modified should the team develop significant new information that warrants review. Should you have any questions concerning this charter, please contact Vince Gaddy or Bob Hagar.

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SUNSI Rev Compl.	☒Yes ☐No	ADAMS	☒Yes ☐No	Reviewer Initials	VGG
Publicly Avail	☐Yes ☒No	Sensitive	☒Yes ☐ No	Sens. Type Initials	VGG

RIV:C/DRP/PBC	C/DRP/PBC	D:DRP	D:DRP
RHagar: jm	VGaddy	KKennedy	
/RA/	**/RA/**	**/RA/**	
04/ 6 /2011	04/ 7 /2011	04/ 7 /2011	

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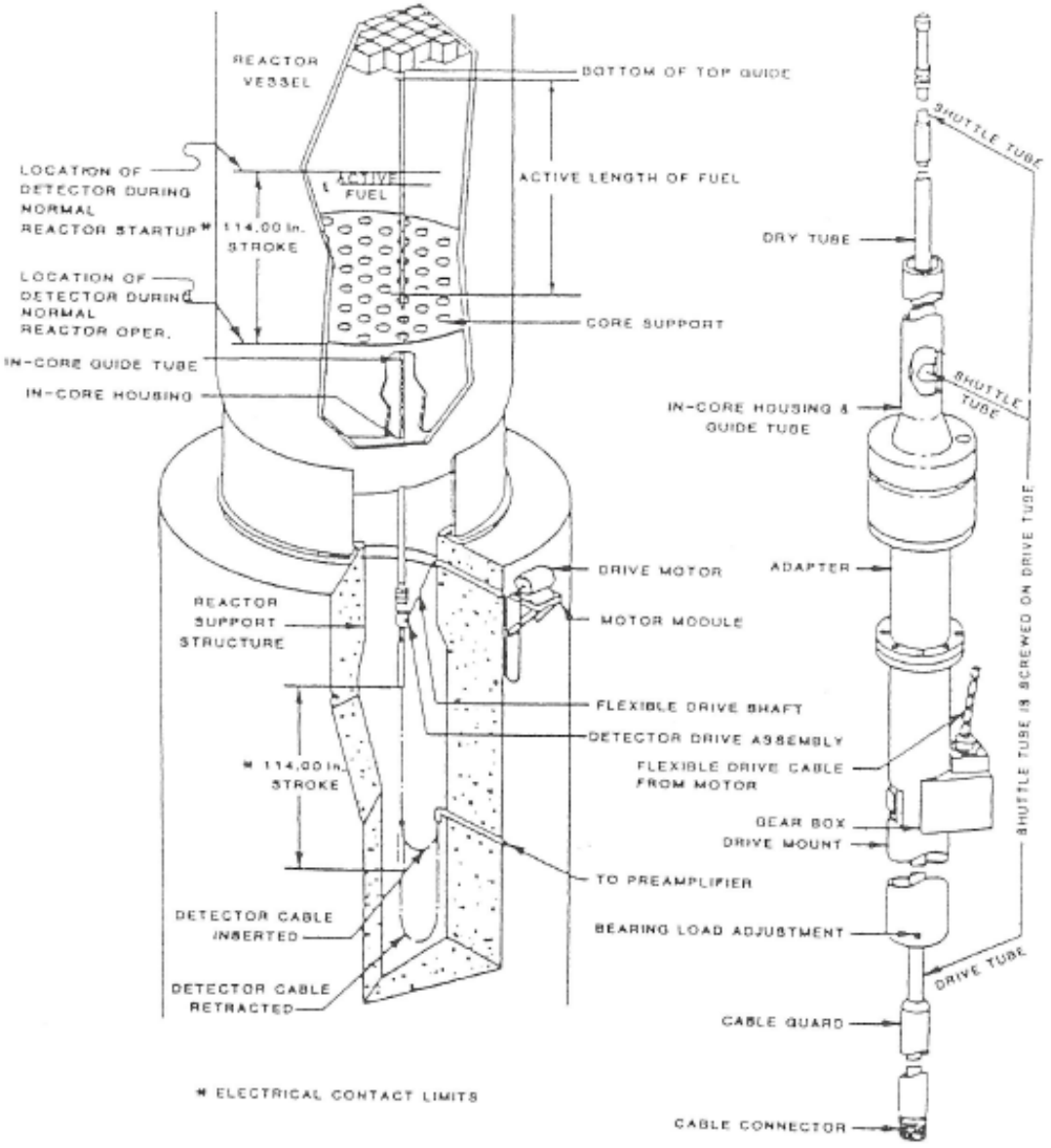
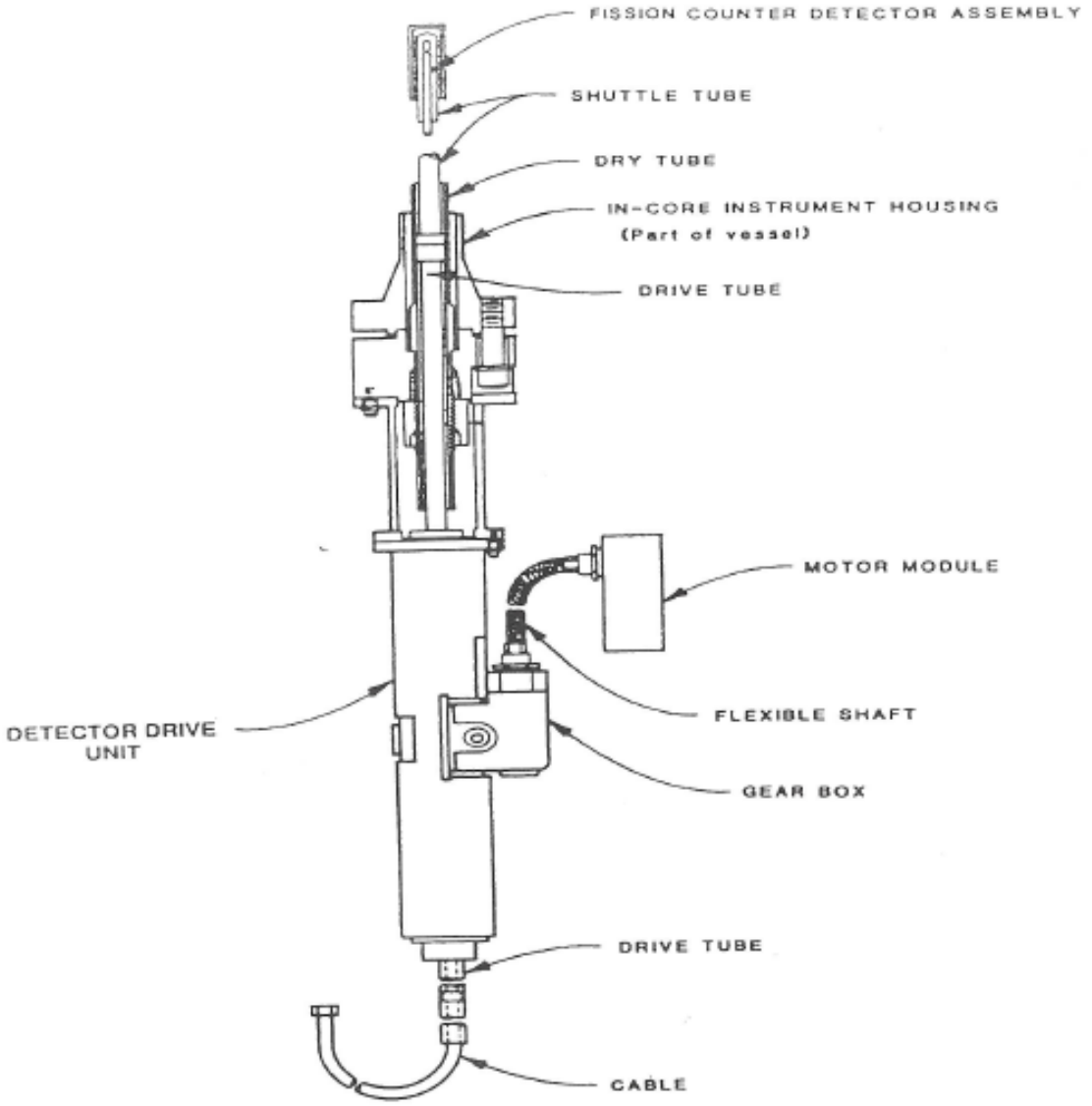


SOURCE RANGE & INTERMEDIATE RANGE DETECTOR DRIVE

Figure 9, Rev. 0

IAC722-00-00



DETECTOR DRIVE UNIT
Figure 12, Rev. 0
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