APPENDIX B

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-482/87-27 Operating License: NPF-42

Docket: 50-482

Licensee: Wolf Creek Nuclear Operating Corporation (WCNOC)
P.O. Box 411
Burlington, Kansas 66839

Facility Name: Wolf Creek Generating Station (WCGS)

Inspection At: Wolf Creek Site, Coffey County, Burlington, Kansas

Inspection Conducted: October 1-30, 1987

Inspectors: for J. E. Cummins, Senior Resident Inspector, Operations — 11/30/87 Date

for B. L. Bartlett, Resident Reactor Inspector, Operations — 11/30/87 Date

for W. F. Smith, Senior Resident Inspector Waterford 3, Project Section A — 11/30/87 Date

M. E. Skow, Reactor Inspector, Test Programs Section, Operations Branch — 4/30/87 Date

Approved: J. P. Jaudon, Chief, Project Section A — 11/30/87 Date

D. M. Kunnicutt, Chief, Test Programs Section, Operations Branch

12/4/87
Date

Inspection Summary

Inspection Conducted October 1-25, 1987 (Report 50-482/87-27)

Areas Inspected: Nonroutine, unannounced inspection including plant status, operational safety verification, monthly surveillance observation, monthly maintenance observation, onsite event followup, physical security verification, radiological protection, refueling activities, and onsite followup of reportable events which occurred between October 10 and 15, 1987.

Results: Within the nine areas inspected, six unresolved items are identified in paragraphs 3a, 3b, 3c, 3d, 4, and 6. Four open items are identified in paragraph 6.

DETAILS

1. Persons Contacted

*B. D. Withers, President and CEO
*R. M. Grant, Vice President, Quality
*F. T. Rhodes, Vice President, Nuclear Operations
*G. D. Boyer, Plant Manager
*O. L. Maynard, Manager, Licensing
*C. M. Estes, Superintendent of Operations
*M. D. Rich, Superintendent of Maintenance
*M. G. Williams, Superintendent of Regulatory, Quality, and Administrative Services
*W. J. Rudolph, QA Manager-WCGS
*A. A. Freitag, Manager, Nuclear Plant Engineering (NPE), WCGS
K. Peterson, Licensing
*G. Pendergrass, Licensing
*W. M. Lindsay, Supervisor, Quality Systems
*C. J. Hoch, QA Technologist
J. Goode, Licensing Engineer
*V. J. MacTaggart, Supervisor, Results Engineering
*S. R. Sparks, Licensing Engineer
*J. C. Hicks, Supervisor, Safety Services
*J. L. Houghton, Operations-Coordinator, Operations
*R. H. Belote, Manager, Nuclear Safety Engineering
C. Fowler, Instrumentation and Control (I&C) Supervisor
M. Nichols, Technical Support Superintendent
T. Morrill, Health Physics Supervisor
J. M. Pippin, Manager, NPE
B. Bergstrom, Acting Manager, NPE Systems
B. McKinney, Superintendent, Test Support
J. W. Johnson, Chief of Security
W. B. Ward, General Counsel

The NRC inspectors also contacted other members of the licensee's staff during the inspection period.

*Denotes those personnel in attendance at the exit meeting held on October 30, 1987.

2. Plant Status

The plant was shutdown for a refueling outage during the inspection period.

3. Onsite Event Followup

During this report period the NRC inspectors performed onsite inspections of the four events discussed below. On October 16, 1987, in response to

these events, the licensee suspended refueling outage work and appointed a task force to investigate and evaluate each of the events. The outage work was suspended for approximately one week, and each job was evaluated prior to being restarted to ensure safety and quality requirements were being met.

a. Two Workers Contaminated

On October 10, 1987, two workers were contaminated while working on a portable self-contained water processing system that had been provided by a vendor (Duratek). The workers were employees of Duratek, and their duties included the operation of the water processing system. The water processing system consisted of five vessels or demineralizers (numbered 0 thru 4) that were mounted on a skid along with the interconnecting hoses and other components, such as valves, that made up the system. The water processing system was set up in the low level drum storage area on the 2000-foot level of the radwaste building. At the time of the event, water from the plant was not being processed; however, because of previous processing operations, the media (i.e., resin/charcoal) in some of the vessels was partially depleted and radioactive. The depleted media was being sluiced out of the No. 2 vessel into the No. 0 vessel so the the No. 2 vessel could be refilled with fresh media. During the sluicing process, the system clogged. In attempting to unclog the system, the workers disconnected a pressurized hose. As a result, radioactive media (charcoal) was blown on the two workers, the low level storage area, the ceiling of the area, and over an 18-foot wall into an adjacent corridor.

Specifically, between 6 a.m., October 10, 1987 and approximately 6 p.m. the workers had performed the following activities:

- Installed two additional vessels in the water processing system and leak tested the system,
- Loaded activated carbon into the No. 0 vessel, and
- Sluiced depleted media from the No. 4 vessel into the No. 0 vessel and added new media to the No. 4 vessel.

Between approximately 6 p.m. and 6:55 p.m., the Duratek workers started sluicing media from the No. 2 vessel to the No. 0 vessel. At approximately 6:55 p.m. they exited the area and notified the radwaste operator that they thought the water level in the floor drain tank receiving the sluice water was too high. The radwaste operator put another floor drain tank on-line to receive the sluice water. At 8 p.m. the Duratek workers returned to the area and attempted to restart sluicing the No. 2 vessel; however, the system was clogged. The workers' attempts to unclog the system included disconnecting hoses which opened up the contaminated system without health physics (HP) being informed.

At approximately 10:15 p.m. the swing shift (3 p.m. to 11 p.m.) radwaste operator observed one of the Duratek workers unhooking hoses and allowing water to flow onto the floor and himself. The radwaste operator also observed that there was some material on the floor that he assumed was new resin.

At approximately 10:45 p.m. the mid-shift (11 p.m. to 7 a.m.) operator checked in on the Duratek workers and observed water and media on the floor, the Duratek skid, and the Duratek workers.

The mid-shift radwaste operator stated that it appeared the Duratek workers were trying to clean up the mess. The Duratek operators asked the radwaste operator to get them some towels and decon soap, and said that they would call HP later. The radwaste operator exited the area and notified HP. He then notified the Duratek workers that HP wanted them to stop work and wait on an HP technician. HP personnel subsequently arrived on the scene, stopped all work in the area, and took the necessary actions to decontaminate the Duratek workers.

The Duratek workers had apparently attempted to clear the clogged line using air and water but were unsuccessful. The workers stated that they had vented off pressure and verified that the pressure indication read "0". They said that they had then disconnected the No. 2 vessel sluice line at the sluice manifold. The line was pressurized and blew the radioactive media over the workers and the area.

Initially it was thought that only the 2.5 liter volume of the disconnected hose blew down; however, the licensee determined by followup investigation that 4.25 cubic foot of media had accumulated in the local sump. This indicates that the No. 2 vessel had been pressurized, not isolated, and had apparently blown down.

The licensee HP organization normally monitors the opening of a system containing radioactive material and specifies the protective clothing and equipment required to be worn by the workers. In this instance, work was performed outside the scope of the existing procedures, and the system containing radioactive material was opened without the required HP controls.

The licensee had implemented Duratek procedures for operating the water processing system. However, these procedures did not include instructions for sluicing media between the vessels, nor did the workers have a procedure for performing maintenance (i.e., opening the system).

Pending further review by the NRC, this matter is considered to be unresolved (482/8727-01). This event was also inspected by an NRC Region IV radiological protection inspector. The results of that inspection will be reported in NRC Inspection Report 50-482/87-28.

b. Pressurizer Hydrogen Burn

On October 14, 1987, at 9:15 a.m. the refueling team inside containment and HP personnel inside containment informed the control room of a loud noise. A welder was welding on Valve BB V-102, an isolation valve to one of the pressurizer pressure/level instrument sensing lines. He informed the control room that, when he struck an arc for his second tack he heard a loud rushing sound, which lasted 5 or 10 seconds. He also stated that the sheetmetal cover, taped over the hole left when Valve BB PSV-8010B (a pressurizer code safety valve) was removed for testing, was blown off by the burn. Investigation by the licensee determined that the only available source of fuel for the burn was hydrogen in the vapor space of the pressurizer. The burn showed up on Control Room Level Recorder BB LR-459 as a change of approximately 13 percent decrease, a 2 percent increase, and then a return to the before burn level values. The burn did not show up on the pressurizer pressure recorders or the reactor coolant system (RCS) temperature recorders. HP sampled the area of the code safety and determined that the airborne activity levels had not increased. Plant safety sampled the pressurizer for hydrogen after the burn; none was found. The licensee's investigation concluded that the probable source of hydrogen was the void space in the pressurizer dome. When the pressurizer was filled with water to 95 percent in order to push out hydrogen, enough hydrogen apparently remained in the dome area so that when the pressurizer was drained back down the hydrogen level was above the 4 percent required for ignition. With the upper instrument root valves removed for maintenance and the code safeties being removed for testing apparently enough oxygen was added to support a burn. Preliminary analysis by the licensee shows that the pressure pulse inside of the pressurizer was approximately 30 psig. The licensee has inspected pressurizer supports and performed an inspection of the spray nozzle through the manway without finding any evidence of damage. The licensee committed that code safety valve BB PSV-8010A, which had been tested and reinstalled would be removed and retested. Engineering Evaluation Request (EER) 87-BB-14 was written to have the vendor evaluate any possible damage to the pressurizer, and the licensee will evaluate the degassing and pressurizer draindown procedures prior to the next refueling outage. Pending the licensee's evaluation concerning possible damage the pressurizer may have sustained and any required corrective action, this will remain an unresolved item (482/8727-02).

c. Worker Fatally Injured

At 8:37 p.m. on October 14, 1987, an unusual event was declared because of a man being injured and a fire in the Train "B" 4160 v AC safeguards switchgear (NB02) room. The man, an electrician, was fatally injured when he came in contact with energized terminals in the NB02 switchgear. The injured man was taken to Coffey County Hospital, where he was pronounced dead. The fire turned out to be

smoke from damaged electrical equipment related to the accident. The unusual event was terminated at 9:11 p.m., on October 14, 1987.

The NB02 switchgear had been taken out of service and isolated by Clearance Order 87-0876-NB for a scheduled outage to clean, inspect, and test the equipment.

The 4160 v AC safeguards power distribution system had two redundant buses, NB01 and NB02. Power was supplied to these buses from two engineered safety features (ESF) transformers, XNB01 and XNB02. ESF Transformer XNB01 supplied normal power to NB01 thru Circuit Breaker NB0112 and alternate power to NB02 thru Circuit Breaker NB0212. ESF Transformer XNB02 supplied normal power to NB02 thru Circuit Breaker NB0209 and alternate power to NB01 thru Circuit Breaker NB0109. These circuit breakers were located in cubicles in the NB switchgear that they were feeding. The NB01 and NB02 switchgear cabinets are located in separate rooms, and the two systems are independent of each other.

For the NB02 maintenance outage, ESF Transformer XNB01 was kept energized in order to supply normal power to the NB01 bus, which was supplying the 4160 v AC safety-related loads required by Technical Specification. Having ESF Transformer XNB01 energized also energized the alternate feed to the NB02 bus, located in Cubicle NB0212. Licensee personnel also decided to keep ESF Transformer XNB02 energized in order to provide an alternate feed to the safety loads on NB01. With ESF Transformer XNB02 energized, the normal feed to NB02, located in Cubicle NB0209, was also energized. The operations shift supervisor, preparing the clearance order to isolate the NB02 switchgear, discussed on the telephone with an electrical maintenance supervisor the fact that both ESF Transformers XNB01 and XNB02 would remain energized, during the NB02 outage, and therefore the feedside of two cubicles, NB0212 and NB0209, in the NB02 switchgear would be energized. However, the electrical maintenance supervisor misunderstood and thought that only the feed side of the NB0212 cubicle would be energized during the NB02 outage.

Prior to starting work on the day shift, electrical maintenance personnel checked the switchgear with voltage detecting instruments but failed to detect that Cubicle NB0209 was energized. "Caution Cubicle Energized" labels were attached to Cubicle NB0212, but none were attached to Cubicle NB0209. During the day shift, electricians cleaned and inspected the cubicles and tested the circuit breakers in Cubicle NB02 except for the NB0212 cubicle and breaker. The day shift personnel thought that Cubicle NB0209 was completely de-energized and performed the maintenance accordingly.

The night shift (5 p.m. to 3 a.m.) relieved the day shift and continued the NB02 maintenance work. The electrician who was killed was working in a potential transformer cabinet which was mounted on top of the NB0209 cubicle. The electricians were working on top of

the NB02 cubicles and had removed the covers from the top of the potential transformer cabinets. With the top off of NB0209 potential transformer cabinet, the energized, stationary disconnect terminals that fed the potential transformer were exposed. It was these exposed terminals that the electrician contacted.

The NB02 maintenance work was being accomplished in accordance with Procedure MPE E009Q-01, Revision 0, "13.8 KV and 4.16 KV Switchgear Inspection and Testing."

Licensee's Procedure MPE E0090-01 contained a number of steps that should have identified the presence of high voltage in the NB02 cubicles. These steps are discussed below:

- Section 6.0 and 6.1 of MPE E009Q-01 stated:

  "6.0 WORK PERFORMANCE INSTRUCTIONS

  NOTE: Recheck to make sure all the supply breakers to the switchgear, tie breaker, (if used), high voltage supply breaker and space heater breaker, are OPEN. High voltage breakers should be in their racked down position.

  6.1 Check the electrical drawings and identify any area(s) which will have high voltage potential present even when the Bus is grounded. List the areas on the Attachment "A" Sign-off Sheet."

The only area listed on Attachment "A" was "NB0212-Feeder from XNB01."

- Step 6.3.9.3 stated: "Using high voltage gloves and testor, check the rossettes to ensure that there is no voltage present. Check phase to phase, and phase to ground."

  The feed side rossettes should have been energized when the check was performed, but the voltage was not detected.

- Step 6.3.9.4 stated: "If no voltage was detected in 6.3.9.3, ensure that each of the high voltage connections is discharged."

  If an attempt had been made to discharge the feed side rossettes, the fact that they were energized would have been detected.

- Step 6.3.9.5 stated: "Clean the insulator and high voltage connection in each tube. Check the insulators for cracks and the rossettes for damaged fingers."

Step 6.3.9.5 was signed off for Cubicle NB0209. This indicated that people performing this step could have been injured, since Steps 6.3.9.3 and 6.3.9.4 were apparently not adequately performed.

- Section 6.4 of MPE E009Q-01 provided the instructions for performing maintenance on the potential transformers.

- Step 6.4.2 and the note preceding it stated:

  "NOTE: Use caution when performing Step 6.4.2. High voltage potential may be present.

  6.4.2 Remove bolted panels as necessary to obtain access to the stationary portion of the high voltage disconnects."

- Step 6.4.3 stated: "Using the high voltage gloves and testor, check the stationary disconnects for high voltage potential. If no potential is found, check that the high voltage connections are discharged."

It was at this point in the procedure that the electrician was injured, apparently without the above steps having been adequately performed.

Pending further NRC review of this event and the licensee's task force findings, this is an unresolved item (482/8727-03).

In addition, during the above event, cooling water flow to the reactor core was lost for approximately 17 minutes, when the reactor operators secured power to the NB01 bus in response to the rescue effort. Approximately one-third of the fuel assemblies were still in the reactor vessel at the time and the refueling cavity was flooded up to greater than 23 feet above the reactor vessel flange for the fuel transfer. This event did not result in any danger to the reactor plant.

d. Engineered Safety Features Actuations

On October 15, 1987, degraded voltage on vital DC Buses NK02 and NK04 caused numerous ESF actuations. On Wednesday, October 14, 1987, the 4160 v AC Bus NB02 was de-energized for routine outage maintenance; this de-energized NG02 and NG04, which are the normal feeds to NK02 and NK04. With the normal feeds de-energized, Batteries NK12 and NK14 picked up the loads on Buses NK02 and NK04. The licensee was aware of the batteries carrying the load and was monitoring bus voltage regularly in the control room, but no specific gravities were taken to monitor battery capacity. The licensee anticipated that NB02 would be returned to service prior to the batteries becoming

depleted. However, because of the electrocution on October 14, 1987 (see paragraph 6.c), Bus NB02 was not returned to service as soon as was originally expected. The batteries became depleted, and at 9 p.m. on October 15, 1987, voltage dropped low enough (85 v DC) on NK04, which feeds 120 AC Bus NN04 v AC Bus NN04, that the following ESF actuations were received:

- Containment purge isolation system actuation
- Fuel building ventilation isolation system actuation
- Control room ventilation isolation system
- One channel of auto switchover of the auxiliary feedwater (AFW) systems suction to the essential service water (ESW) system for auto switchover to occur, two required out of three total
- Start of motor driven AFW pump "A", and
- Loss of coolant accident and shutdown sequencer actuation.

The control room operators placed the switch for the motor driven auxiliary feed pump "A" in pull-to-lock position, suspended fuel movement and determined the cause of the ESF actuations. After it was determined that depletion of the batteries caused the ESF actuations, the operators started the documentation required in order to supply alternate AC power to Inverter NK24 to restore power to 120 v DC Bus NN04. At 11:32 p.m., prior to the temporary modification being implemented, Battery NK12 became depleted. This caused actuation of those logic circuits needing 2 out of 4 inputs and gave the following results:

- ESF Pump "A" auto started, and the AFW systems automatically switched over to ESW systems as the water source.
- The 4160 v AC vital Bus NB01 de-energized on an indicated undervoltage condition (no undervoltage in fact existed).
- All "A" train equipment automatically stripped off of Bus NB01; this caused a loss of residual heat removal shutdown cooling to the core.
- Diesel Generator "A" automatically started and closed onto Bus NB01, restoring power to the bus.
- Residual heat removal pump "A" and spent fuel pool cooling pump "A" were manually restarted; shutdown cooling was lost for approximately 30 seconds, but because of the large volume of water over the reactor core, there was apparently no obvious temperature rise.

Until temporary power was supplied to either NK02 or NK04, the equipment had to be kept in the actuated condition. Approximately 3 hours after the loss of Bus NK12, while investigating an unexplained increase in condensate storage tank level, the operators observed steam generator wet lay-up levels greater than 25 inches, which is a indication pegged high and a steam generator pressure of 100 psig which correspondes to the discharge pressure of the emergency service water pump.

It was at this time that the operators discovered that the manual isolation valves for emergency service water to auxilliary feedwater, previously thought to be closed, had been reopened on October 8, 1987. Operator aid magnetic tags on the control board indicated the cross connect valves were shut. Although the auxiliary feedwater pumps were stopped, the pressure in the essential service water system was high enough to force water through the AFW pumps and into the minimum flow lines to the condensate storage tank and through the main discharge lines into all four steam generators. Over 3 hours, approximately 10,000 gallons of lake water had been placed in the condensate storage tank and in each of the steam generators. This caused the main steam lines to be completely filled with water. The operators manually isolated the auxilliary feedwater connect to essential service water. The licensee's investigation of the event has determined:

- The steam generator vendor's preliminary analysis of the event has indicated that the steam generators have suffered no damage from the poor chemistry of the lake water.

- Steam generator sludge lancing should be conducted as was originally scheduled.

- An analysis of the batteries for possible damage caused by the deep discharge should be performed.

- Operator aids (magnetic tags) should be controlled to ensure they reflect the true status of equipment.

- The control work authority for outage related work has been moved to the control room to ensure better communications with the plant operators.

- Procedures will be prepared prior to the start of the next refueling outage to allow immediate connection of all NK buses to alternate power supplies as required.

Completion of the licensee investigation and implementation of their corrective actions will remain an unresolved item (482/8727-04).

4. Operational Safety Verification

The NRC inspectors verified that the facility is being operated safely and in conformance with regulatory requirements by direct observation of licensee facilities, tours of the facility, interviews and discussions with licensee personnel, independent verification of safety system status and limiting conditions for operations, and reviewing facility records. The NRC inspectors, by observation of randomly selected activities and interview of personnel verified that physical security, radiation protection, and fire protection activities were controlled.

By observing accessible components for correct valve position and electrical breaker position and by observing control room indications, the NRC inspectors confirmed the operability of selected portions of safety-related systems. The NRC inspectors also visually inspected safety components for leakage, physical damage, and other impairments that could prevent these components from performing their designed safety functions.

Selected NRC inspector observations are discussed below:

- On October 12, 1987, during a routine plant tour, the NRC inspector observed Spool Piece EF-124-HBC-10" removed downstream of Essential Service Water (EF) Valves EF V-048 and EF V-050. No workers were observed in the vicinity and the cleanliness requirements of Plant Administrative Procedures ADM 01-034 and ADM 01-110 were not being complied with in that the open ends of the remaining pipe were not covered to prevent entry of foreign material. This matter was brought to the licensee's attention and promptly corrected.

- On October 13, 1987, the NRC resident inspectors at Callaway informed the Wolf Creek resident inspectors of a problem with the control room ventilation isolation system (CRVIS). As discussed in NRC Inspection Report 50-483/87-23, Callaway identified problems with the operability of CRVIS. These identified problems centered on mispositioned, which prevented pressurization of equipment rooms when required. In response to this information, the NRC resident inspectors asked the licensee if the same situation existed at WCNOC. At the NRC exit meeting held on October 30, 1987, the licensee committed to resolve this item prior to startup from the refueling outage. The licensee's response to this information is not yet completed, and this will be considered an unresolved item (482/8727-05).

5. Monthly Surveillance Observation

The NRC inspectors observed selected portions of the performance of surveillance testing and/or reviewed completed surveillance test procedures to verify that surveillance activities were performed in accordance with Technical Specification (TS) requirements and

administrative procedures. The NRC inspectors considered the following elements while inspecting surveillance activities:

- Testing was being accomplished by qualified personnel in accordance with an approved procedure.
- The surveillance procedure conformed to TS requirements.
- Required test instrumentation was calibrated.
- TS limiting conditions for operation (LCO) were satisfied.
- Test data was accurate and complete. Where appropriate, the NRC inspectors performed independent calculations of selected test data to verify their accuracy.
- The performance of the surveillance procedure conformed to applicable administrative procedures.
- The surveillance was performed within the required frequency and the test results met the required limits.

Surveillances witnessed and/or reviewed by the NRC inspectors are listed below:

STS MT-039, Revision 2, "Chemical and Volume Control System Relief Valve Testing," performed on October 6, 1987

STS IC-506A, Revision 3, "Calibration of Steam Generator Narrow-Range Level Transmitters," performed on October 7, 1987

STS IC-926, Revision 1, "Surveillance Test Component Cooling Water System Automatic Valve Actuation," performed on October 7, 1987

STS MT-027, Revision 3, "Snubber Functional Test," performed on October 7 and 14, 1987

STS MT-042, Revision 2, "Containment Spray System Relief Valve Test," performed on October 8, 1987

No violations or deviations were identified.

6. Monthly Maintenance Observation

The NRC inspector observed maintenance activities performed on safety-related systems and components to verify that these activities were conducted in accordance with approved procedures, Technical Specifications, and applicable industry codes and standards. The

following elements were considered by the NRC inspector during the observation and/or review of the maintenance activities:

- o LCOs were met and, where applicable, redundant components were operable.
- o Activities complied with adequate administrative controls.
- o Where required, adequate, approved, and up-to-date procedures were used.
- o Craftsmen were qualified to accomplish the designated task and technical expertise (i.e., engineering, health physics, operations) was made available when appropriate.
- o Replacement parts and materials being used were properly certified.
- o Required radiological controls were implemented.
- o Fire prevention controls were implemented where appropriate.
- o Required alignments and surveillances to verify post maintenance operability were performed.
- o Quality control hold points and/or checklists were used when appropriate and quality control personnel observed designated work activities.

Selected portions of the maintenance activities accomplished on the work requests (WR) listed below were observed and related documentation reviewed by the NRC inspector:

No.	Activity
WR 11361-85	EM V8853B SI "B" discharge relief leak
WR 91041-87	EJ FCV-611 valve did not reopen automatically
WR 60392-87	Hydrogen Mixing Fans CGN03B refueling inspection
WR 60051-87	3" Pressure Relief Valve BG V-8120, 5 year bench test
WR 60048-87	6" Pressurizer Safety Valve BB HV-8010A verify setpoints and operability
WR 60026-87	Snubbers, Mechanical 1/4/EG-16R502 functional test
WR 60056-87	3/4" Pressure Relief Valve EN V-057, 5 year setpoint and operability test

WR 02828-87	EF V-090 replace reducer
WR 60049-87	6" Pressurizer Safety Valve BB HV-8010B verify setpoints and operability
WR 60039-87	Hydraulic Snubbers PD 89070-002 steam generator
WR 60238-87	Main Breaker/NG0201, performed maintenance in accordance with Procedure MPE E017Q-04, Revision 4, observed October 14, 1987
WR 60224-87	Switchgear Cubicle and Bus/NB02, performed in accordance with Procedure MPE E008Q-01, Revision 0, observed October 14, 1987
WR 60229-87	LCFDR NG02 Circuit Breaker/NB0213, performed in accordance with Procedure MPE E009Q-02, Revision 4, observed October 14, 1987
FHP 02-008	Revision 1, "Reactor Cavity Seal Ring Installation and Removal," performed on October 8, 1987
FHP 02-009	Revision 3, "Reactor Vessel Stud Removal, Cleaning, and Installation"
WR 00469-87	Underground coat and wrap on Line AL-001-HBD-12"
WR 02887-87	Inspect and rework as required, foam penetration closures, Fire Zones C-22, C-33, and C-34
WR 02939-87	Battery NK-12, clean cell, terminals, replace cell connections, and check intercell resistance

Selected NRC inspector observations are discussed below:

o During this inspection period all pressurizer code safety relief valves were tested to verify their setpoints with the following results:

Valve	As-Found Setpoint
BB PSV-8010A	*2390 psig

Valve	As-Found Setpoint
BB PSV-8010B	*2310 psig
BB PSV-8010C	*2185 psig

*Should be 2485 pound per square inch gage (psig) plus or minus 1%

With the pressurizer power operated relief valves set for 2335 psig and normal plant operating pressure around 2235 psig, the results of the tests for Valves BB PSV-8010B and BB PSV-8010C were placed in doubt. To test these valves, the licensee removed them from the pressurizer and using a supply of pressurized nitrogen connected to the valve inlet slowly increased the pressure until the valve lifted. The valves were preheated for 8 hours to ensure proper valve body temperature prior to testing. The licensee is attempting to discover the reasons for the low as-found setpoints. Testing of these code safeties is discussed in NRC Inspection Report 50-482/86-34, paragraph 15 (Open Item 482/8634-04). At the NRC exit meeting held on October 30, 1987, the licensee committed to resolving this item prior to startup after the refueling outage. Pending the licensee's resolution of the causes of low as-found setpoints of the pressurizer code safeties, this will be considered an unresolved item (482/8727-06).

- NRC Inspection Reports 50-482/87-15, paragraph 5 and 50-482/87-20, paragraph 5 discuss problems that the licensee has been experiencing with erosion of pipe. On October 2, 1987, NRC's Office of Nuclear Reactor Regulation (NRR) sent the licensee a letter confirming the NRC staff's understanding of the licensee's actions.

  For tracking purposes, the items listed below have been taken from the NRR letter and will be made open items:

  a. Prior to returning to operation following the 1987 refueling outage, the licensee will complete the ultrasonic inspection of all safety-related piping locations having a high-probability of erosion/corrosion damage (Open Item 482/8727-07).

  b. Prior to returning to operation following the 1987 refueling outage, the licensee will replace the areas where piping has experienced through wall or below minimum wall thinning with stainless steel components (Open Item 482/8727-08).

  c. Prior to returning to operation following the 1987 refueling outage, the licensee will repair or replace all components that are projected to erode/corrode to less than minimum wall thickness during the third fuel cycle (Open Item 482/8727-09).

  d. By November 30, 1987, the licensee will provide for NRR review a plan and schedule for corrective measures that will eliminate erosion/corrosion related pipe thinning caused by flow disturbances in piping systems as a result of butterfly valve throttling and piping configurations (Open Item 482/8727-10).

7. Physical Security Verification

The NRC inspectors verified that the facility physical security plan (PSP) is being complied with by direct observation of licensee facilities and security personnel.

The NRC inspectors by observation of randomly selected activities verified that search equipment was operable, that the protected area barriers and vital area barriers were well maintained, that access control procedures were followed and that appropriate compensatory measures were used when equipment was inoperable.

No violations or deviations were identified.

8. Radiological Protection

By performing the following activities, the NRC inspectors verified that radiologically related activities were controlled in accordance with the licensee's procedures and regulatory requirements:

- Reviewed documents such as active radiation work permits and the health physics shift turnover log.
- Observed personnel activities in the radiologically controlled area (RCA) such as:
  - Use of the required dosimetry equipment,
  - "Frisking out" of the RCA, and
  - Wearing of appropriate anti-contamination clothing where required.
- Inspected postings of radiation and contaminated areas.
- Discussed activities with radiation workers and health physics supervisors.

No violations or deviations were identified.

9. Refueling Activities

The NRC inspectors observed refueling activities related to reactor vessel head removal, installation of the reactor cavity seal ring, flooding of refueling pool, and removal of the upper internals. The NRC inspectors also observed fuel handling operations in the reactor and the spent fuel pool area while the fuel assemblies were being transferred from the reactor vessel to the spent fuel pool. The refueling activities were performed in accordance with Licensee Procedures FHP 02-001, Revision 6,

"Refueling Procedure," and FHP 02-011, Revision 9, "Fuel Shuffle and Position Verification." The NRC inspectors also verified that operability of refueling-related equipment was periodically verified by the licensee.

10. Followup of Events

One objective of this part of the inspection was to followup on short-term corrective actions taken by the licensee subsequent to a series of four incidents which occurred between October 10 and 15, 1987, during the second WCGS refueling outage. The second objective was to establish confidence, by observation of work in progress and by review of work control procedures, that the licensee had sufficient controls over work, clearances, procedure development, and that job interface was such that the outage can proceed in a safe manner.

The series of four events, as discussed previously in this inspection report, occurred as follows:

- On October 10, 1987, about 4 cubic feet of radioactive resin was spilled in an enclosed room in the radioactive waste building when a pressurized hose was disconnected during a resin transfer.

- On October 14, 1987, a combustible mixture of gases ignited inside the reactor coolant system pressurizer while welding on a pressurizer level instrument isolation valve.

- On October 10, 1987, an electrician was fatally electrocuted while cleaning electrical switchgear containing energized circuits.

- During the evening of October 15 and the morning of October 16, 1987, Engineered Safety Feature (ESF) actuations occurred as a result of decreased battery bus voltage. The voltage degradation reportedly occurred because safety-related electrical Bus NB-02 was deenergized longer than expected for outage work. The delay appeared to be caused, in part, by recovery actions from the electrocution incident. Because of an improper isolation of the Auxiliary Feedwater System, the ESF actuation resulted in lake water contamination of all four steam generators when the Auxiliary Feedwater System actuated.

The licensee temporarily suspended the refueling outage, with exception of: (1) completing the removal of three remaining fuel assemblies from the reactor vessel, thus placing the reactor in a completely defueled condition, (2) steam generator cleanup, and (3) getting power back to electrical Bus NB-02. The licensee stated that these activities were completed to enhance safety and preclude degradation of the secondary systems. The NRC staff found those actions acceptable.

In a meeting in the NRC Region IV office, as stated in WCNOC Letter WM 87-0277 dated October 20, 1987, the licensee described a three-phase approach to the resumption of the outage. This was preceded by briefings to project personnel on the work stoppage and the formation

of teams to investigate the four incidents. Although the events did not, on the surface, appear to be related, the licensee committed to review the events together to determine if a common root cause existed.

Phase One of the recovery consisted of resumption of selected jobs, which were evaluated as having little or no potential for causing additional incidents like those described above. Examples of Phase One recovery activities included testing of water-operated valves, erosion/corrosion measurements, fire protection inspection/rework, turbine generator work, service water system work, and shuffling of fuel in the spent fuel pool (but no movement of fuel into the reactor). Some of these activities were was observed by the NRC inspectors, and it did not appear that any safety problems would result, provided the work continued to progress in the orderly, controlled manner observed.

Phase Two of the recovery resumed a limited amount of additional work after each work group had conducted meetings with employees and contractors emphasizing the need to do the job right, to follow procedures, and to understand fully the job requirements and safety precautions. Interviews with various department supervisors and on the job discussions with selected workers, QC inspectors, and HP technicians led the NRC inspectors to conclude that the meetings had had a positive impact on job performance. The NRC inspectors cautioned licensee management at the conclusion of the inspection that the four incidents themselves may have made the strongest impression rather than the meetings. The licensee was encouraged to ensure, through additional actions, that the workers' current resolve to do their jobs correctly and safely does not fade with time.

As the jobs under Phase Two resumed, the NRC inspectors observed work in progress, conducted candid discussions with workers, and reviewed the procedures and documents used by the workers. As committed in Letter WM 87-0277, it appeared that the jobs were adequately prebriefed, "walked-down" to provide added assurance that each job can proceed safely, and that the procedures were adequate for the circumstances.

The NRC inspectors identified two areas where, if left unchecked, could result in problems in the future. On October 27, 1987, the NRC inspectors observed two Instrumentation and Control (I&C) technicians performing Surveillance Test Procedure STS-IC-708, which is a time-response test of the Main Steamline Pressure Instrument Channel D. The NRC inspectors noted that the technicians had checked off a step in the procedure before it was completed. The step directed the reader to perform a series of steps in another part of the procedure. When the NRC inspectors questioned the the checking off of a step in the procedure prior to completion, the technicians indicated that occasionally they will check or sign off a step such as this to acknowledge understanding and at other times they sign off to document completion. Although ADM 02-300, "Surveillance Testing," does not specifically address this practice, the NRC inspectors expressed concern that if a procedure is interrupted, confusion may occur when the task is resumed. Licensee management stated

that it was expected that people would only sign or check off steps in a procedure upon completion of the steps, and that the appropriate training would be implemented. The NRC inspectors brought this to the attention of the resident inspector for routine followup.

A second observation brought to the attention of licensee management was the existence of numerous puddles of water on the floor in radiologically controlled areas, particularly in the containment building. On one hand the NRC inspectors noted emphasis in general employee training on treating unidentified puddles as potential radioactive spills, but in practice nobody appeared to be overly concerned about avoiding them or getting them cleaned up. The NRC inspectors expressed concern that, as time goes on, more of these puddles may be contaminated and, if ignored, could result in an uncontrolled spread of contamination. The licensee acknowledged this and agreed with this comment. This will be followed up during the resident inspector's routine inspection tours.

On October 30, 1987, the licensee issued a revised outage schedule which reflected a 2-week delay as a result of the work stoppage and, in addition, another week of time inserted into numerous work segments to allow for walk-downs and a more deliberate work pace. This was an indication of WCNOC management's resolve to complete the refueling outage at a slower pace with more emphasis on planning and safety.

As part of the inspection interview process the NRC inspectors met with and interviewed five operator personnel, including a shift supervisor (SS), a senior reactor operator (SRO), two reactor operators (ROs), and a nonlicensed equipment operator. The operators all stated that the outage pace had slowed. They appeared to understand the new controls placed on the magnetic "isolated" signs used in the control room. The operators appeared to understand that they had the authority to limit the number of personnel and activities taking place in the control room. As part of their corrective action, the licensee moved the SS back to an alcove in the control room to perform his outage-related duties. The operators expressed the opinion that this move improved communications between the SS and the other operators. The SS also stated that, as part of the corrective action, he was attending the morning plan of the day meetings. The operator's opinion was that his attendance at the meetings could improve some perceived problems with scheduling of individual jobs. This, they hoped, would improve their clearance processing work load. In addition, the NRC inspectors found that, during control room observation, the operators conducted their activities in a professional manner.

The NRC inspectors reviewed changes made to procedures as a direct result of the incidents discussed above, and without benefit of detailed investigation as to causes:

- ADM 02-100, Revision 15, "Clearance Order Procedure," was changed on October 20, 1987, to require addition of magnetic status tags placed

on the main control board (MCB) to the applicable clearance order to ensure removal of the tags when the clearance order is closed. These tags were previously not under any administrative controls.

- ADM 02-110, Revision 9, "Control of Information Tagging," was revised on October 28, 1987, to support the change to ADM 02-100 above.

- MPE E009Q-01, Revision 1, dated October 15, 1987, "13.8 KV and 4.16 KV Switchgear Inspection and Testing"

- ADM 08-201, Revision 3, Temporary Procedure Change MA 87-410, dated October 27, 1987, "Control of Maintenance and Modifications"

- ADM 01-057, Revision 12, Temporary Procedure Change MA 87-349, "Work Request"

- There were several changes and added procedures associated with the resin spill. These are discussed in NRC Inspection Report 50-482/87-28.

The NRC inspectors also reviewed the following administrative control procedures, and found no significant problems:

- ADM 02-021, Revision 9, "Use of Procedures in Operations." This procedure establishes the guidelines for the use of Operation Procedures.

- ADM 02-300, Revision 10, "Surveillance Testing." This procedure discusses the conduct of surveillances and the use of surveillance procedures.

- ADM 02-100, Revision 15, "Clearance Order Procedure." The purpose of this procedure is to provide methods to ensure the safety of personnel and protection of plant equipment during maintenance and operation. It also ensures that safety-related equipment removal from, and restoration to, service is independently verified.

- ADM 02-110, Revision 9, "Control of Information Tagging." This procedure describes the authorization, documentation, and review required to ensure operator aids and information tags are current, complete, and necessary.

- ADM 07-100, Revision 32, "Preparation, Review, Approval, and Distribution of WCGS Procedures." This procedure delineates the process for preparation, review, approval, and distribution of procedures required by Section G of the Technical Specifications.

At the conclusion of this inspection, the licensee had not entered Phase Three of the outage resumption. The licensee committed not to go into full resumption until completion of the investigations into the four

incidents above, completion of all immediate corrective actions identified as a result of the investigations and management procedure, and notification to the NRC of WCNOC's intention to resume.

- o Fuel handling operations were conducted in accordance with approved procedures.
- o Technical Specification requirements were met.
- o Good housekeeping and loose object control were maintained in the refueling cavity and the spent fuel pool areas.
- o Licensed and/or qualified personnel performed tasks and manned stations where required by technical specifications or procedures.

During discussion, the NRC inspector determined that the licensee had performed a safety evaluation in accordance with 10 CFR Part 50.59 for the new core load.

No violations or deviations were identified.

11. Unresolved Item

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable item, items of noncompliance, or deviations. Six unresolved items disclosed during the inspection are discussed in paragraphs 3a, 3b, 3c, 3d, 4, and 6.

12. Exit Meeting

The NRC inspectors met with licensee personnel to discuss the scope and findings of this inspection on October 30, 1987.