U.S. NUCLEAR REGULATORY COMMISSION

REGION II

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Licensee:	Duke Power Company
Facility:	Catawba Nuclear Station, Units 1 and 2
Location:	422 South Church Street Charlotte, NC 28242
Dates:	September 1 - October 12, 1996
Inspectors:	P. Balmain, Resident Inspector N. Economos, Reactor Inspector
Approved by:	Leonard Wert, Acting Chief, Projects Branch 1 Division of Reactor Projects

ENCLOSURE

EXECUTIVE SUMMARY

Catawba Nuclear Station, Units 1 & 2
NRC Inspection Report 50-413/96-15, 50-414/96-15

This integrated inspection included aspects of Steam Generator Replacement Project activities in the area of engineering and plant support. The report covers a 6-week period of announced inspection performed by resident and regional reactor inspectors.

Engineering

- Restoration of piping, piping supports, and instrumentation was performed effectively (Section E1.3).

- The licensee's control and implementation of the startup testing program was effective. Hot gap measurement and visual leak inspection efforts were well coordinated and executed (Sections E1.4 and E1.5).

- Use of the Plant Simulator to familiarize and review load rejection test procedures and expected plant response with control room shift crews prior to performing transient tests was good. Senior operators and reactor operators demonstrated a proactive attitude during this training (Section E1.4).

- Unit 1 Lower Containment area housekeeping conditions declined during this inspection period. The number of tools and miscellaneous equipment observed to be left in the lower containment areas increased, apparently as the result of physical access to the containment areas being reduced. The licensee increased attention to housekeeping and took appropriate actions following identification of the issues (Section E1.6).

Plant Support

- Radiation protection performance during the steam generator replacement outage was very good. The work was completed well under established radiation protection goals for steam generator replacement and outage activities. The licensee's efforts and implementation of a good shutdown crud burst, temporary shielding, and ALARA (As Low As Reasonably Achievable) exposure planning resulted in excellent performance (Section R1.1).

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Report Details

Summary of Unit 1 Plant Status

The Unit began the period defueled with steam generator replacement activities in progress. Refueling activities began on September 7, 1996, and final Steam Generator Replacement Project (SGRP) secondary system welding activities were completed on September 8. Refueling was completed and preparations for unit heatup began on September 15. The unit entered reactor startup mode on October 2 and was on-line October 4. The unit reached full power on October 10. The duration of the steam generator replacement was approximately 113 days, which exceeded the target duration of 100 days. The delay was due to steam generator secondary welding problems and plant equipment problems during startup.

Review of UFSAR Commitments

A recent discovery of a licensee operating their facility in a manner contrary to the Updated Final Safety Analysis Report (UFSAR) description highlighted the need for a special focus review that compares plant practices, procedures, and/or parameters to the UFSAR descriptions. While performing inspections discussed in this report, the inspectors reviewed the applicable portions of the UFSAR that related to the areas inspected. The inspectors verified that the UFSAR wording was consistent with the observed plant practices, procedures, and/or parameters. No deficiencies were identified.

I. Engineering

E1 Conduct of Engineering

E1.1 General Comments-Steam Generator Replacement Outage Summary

Unit 1 steam generator replacement activities were completed during this inspection period. In general, the licensee's management and execution of steam generator replacement activities was good. The licensee's preparation and planning for the outage was evident in several areas where good results were achieved; including facility preparations, removal and storage of old steam generators, fit-up of new steam generators, and startup testing. Overall radiation protection performance during the outage was very good because of an effective crud burst and ALARA planning. One area of significant challenge concerned problems encountered with manual secondary system welding, which resulted in part from insufficient preparation and training.

E1.2 Steam Generator Replacement

a. Inspection Scope (50001)

Weld process control records were reviewed to determine the adequacy of the documentation of fabrication. Additionally, an inspection of SGRP safety-related welds was conducted.

b. Observations and Findings

Weld process control records were selected at random for review. The records were reviewed for completeness, accuracy, compliance with site Welding Manual requirements and regulatory commitments. The review focused on applicable weld fabrication requirements, inspection of Quality Control (QC) and Authorized Nuclear Inspector hold points, documentation of weld repairs, filler metal used, identification of welders, and Non-Destructive Examination (NDE) requirements as applicable.

Field Welds selected for review were as follows:

Weld	Size	System	Comments
CF038-1	16"x0.844	Main Feedwater Nozzle "A" Loop	No random inspections documented.
CF039-1	16"x0.844	Main Feedwater Nozzle "B" Loop	No random inspections documented.
CF040-1	16"x0.844	Main Feedwater Nozzle "C" Loop	Four repairs before accepted by Radiographic Testing (RT). QC hold deleted by Technical Support.
CF041-1	16"x0.844	Main Feedwater Nozzle "D" Loop	No random QC inspections documented.
1BB127-05	3"x0.438	SG Blowdown	QC hold pt. for purge deleted by Technical Support. Four repairs before accepted by RT.

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1BB134-04	3"x0.438	SG Blowdown	Six repairs before accepted by RT.
1BW018-35	3"x0.438	SG Wet Layup Recirculation	One repair before accepted by RT.
CF002-13	18"x0.938	Main Feedwater Loop "A"	Two repairs before accepted by RT.
CF003-4	18"x0.938	Main Feedwater Loop "A"	Four repairs before accepted by RT.
1SM24-26	32"x1.478	Main Steam Loop "C"	One repair before accepted by RT.
1SM29-36	32"x1.478	Main Steam Loop "B"	Six repairs before accepted by RT.
CF002-4	18"x0.938	Main Feedwater Loop "A"	Five repairs before accepted by RT.

The inspector noted the following:

Records of welds fabricated prior to August 8, 1996, showed that for the most part random QC inspections of weld process attributes (i.e., pre-heat, interpass, temperature, welder identification, and filler metal verification) were not being documented. However, after the above date, random QC checks of the attributes were being documented on the forms provided.

In reference to main feedwater weld CF040-1 identified above, the review disclosed that the weld was fabricated on August 7, 1996, and subsequently rejected by visual for a root condition which was subsequently confirmed and rejected by radiography on August 9, 1996. No further repairs were performed on this joint until August 31, 1996. At that time, the weld repair was radiographed and again rejected on September 1, 1996, for a root condition. This weld was repaired again and rejected two more times by RT before being accepted on September 3, 1996. During this review, the inspector noted that initially, the licensee attempted to repair the root condition by grinding. Due to the extensive grinding required to remove the defect, the joint was weld repaired. During the conduct of these weld repairs all QC hold points were inspected as required. In addition to documenting this corrective action, the Quality Assurance (QA) manager deleted the non-applicable QC

hold points, on August 27, 1996. The deleted hold points applied to welding (i.e., fitup and preheat). Although deletion of QC hold points was permitted by the procedure controlling inspection of QA welds, the inspector noted that it was not an often used practice. In conclusion, the inspector determined that in this case, deleting these QC hold points had no adverse effect on weld quality or plant safety.

c. Conclusions

The weld process control records review disclosed that the licensee was maintaining a good record of weld fabrication and inspections of safety-related welds. Documentation of random QC inspections improved following the work stoppage for process control problems identified on August 8-9, 1996. The details of the process control problems and work stoppage was discussed in Inspection Report 50-413,414/96-12.

E1.3 Interference Removal and Restoration

a. Inspection Scope (50001)

The inspector performed walkdowns and reviewed maintenance work order and modification documentation associated with SGRP Interference Removal and Restoration.

b. Observations and Findings

Restoration of Piping, Restraints, Snubbers and Supports

The inspector performed walkdowns of the A SG cavity following completion of SG installation activities. The inspector verified that selected piping supports and snubbers associated with the SG blowdown, wet layup and main steam systems were installed properly. The inspector also performed a review of the supporting Work Order (WO) documentation listed below and found no discrepancies. The inspector reviewed corrective action documentation of discrepancies identified during the licensee's walkdowns of system restoration and found that the licensee took appropriate actions to properly identify and correct snubber and support installation problems (PIPs 1-C96-2466,2492).

- WO 95024972 Remove/Install New Feedwater (CF) Piping SG 1A
- WO 95024654 Reroute SG Blowdown Recycle (BB)/Wet Lay-Up (BW) Piping and Supports
- WO 95096811 Remove/Replace Auxiliary Feedwater (CA) Piping in SG 1A Cavity

Restoration of Instrumentation

The licensee performed modifications to instrumentation affected by the SG replacement. These changes were controlled by modification NSM CN-19815, Replacement SG Instrumentation and Control. The inspector reviewed the final scope document and performed a walkdown of the A SG wide range and narrow range SG level instrumentation. During the walkdown the inspector verified that instrument tubing was installed and insulated as required by modification documentation.

c. Conclusions

Restoration of piping, piping supports, and instrumentation was performed effectively.

E1.4 Steam Generator Post-Installation Verification and Testing

a. Inspection Scope (50001)

The inspector conducted post-installation verification inspections in the areas of startup testing preparations, hot gap measurements, visual leak inspections of primary and secondary systems, instrumentation calibration, and operator training.

b. Observations and Findings

Startup Testing Preparations

The inspector reviewed the licensee's startup testing preparations and observed that the performance of tests conducted up to Mode 2 was controlled through the outage schedule. Included were hot gap verifications at various temperature plateaus and visual leak inspections at operating temperature/pressure. Control of startup testing from Mode 2 through full power was integrated and controlled through procedure PT/0/A/4150/01, Controlling Procedure for Startup Physics Testing, and included SG level control system verification, load rejection tests, Reactor Vessel Level Indicating System (RVLIS) verification, reactor core performance, and steam generator thermal performance. The licensee's test plan also included a moisture carryover test after approximately one month of full power operation and a natural circulation verification test during a scheduled controlled shutdown.

Hot Gap Measurements and Visual Leak Inspections

At several temperature plateaus during primary system heatup the licensee performed hot gap measurements at support locations on the reactor coolant pump supports, steam generator lower lateral supports, and upper lateral supports. The licensee performed some shim adjustments during the heatup in order to meet the predicted gap

requirements for full temperature conditions. Contingencies to cool the unit down for shim adjustments were not needed. The inspector reviewed gap measurement data and verified that as left final gap measurements met acceptance criteria.

In lieu of hydrostatic pressure testing for welded repairs and installation of replacement welding, the licensee utilized ASME Code Case N-416-1, Alternative Pressure Test Requirements for Welded Repairs or Installation of Replacement Items by Welding, Class 1, 2, and 3 Section XI, Division I. This code case was approved for use at Catawba by the NRC on March 6, 1995, based in part on industry experience that has demonstrated that leaks are not being discovered as a result of hydrostatic test pressures propagating a pre-existing flaw through wall. The inspector verified that the licensee implemented the requirements of Code Case N-416-1 (procedure MP/0/A/7650/088). The licensee identified approximately 10 small active leaks from pipe caps, seat leakage, and valve packing during the walkdown. These leaks were subsequently corrected. No leaks were detected associated with SG weld installation. From discussions with personnel who performed the walkdowns the inspector discerned that the number of active leaks identified was less than the number identified following previous outages. The inspector concluded that both the hot gap measurement and visual leak inspection efforts were well coordinated and executed.

Instrumentation Calibration

Unit 1 License Amendment Number 151, issued on August 29, 1996, addressed instrumentation setpoints for the reactor trip system and the engineered safety features system. The inspector reviewed calculations used to establish the new narrow range level instrumentation setpoint, DPC-1210-04-00-0004, Instrument Loop Uncertainty for Steam Generator Narrow Range Level and DPC-1201.37-00-0001, Replacement Steam Generator Level Control System Setpoints for MNS Units 1 and 2, and CNS Unit 1. The inspector verified that narrow range level trip setpoints established through the licensee's calculations were translated properly into calibration procedures and reflected Technical Specification (TS) values. The inspector reviewed instrumentation calibration procedure IP/1/A/3222/ 014A, Steam Generator Narrow Range Level Channel 1 and completed calibration data sheets (WO 96019199-02) and verified that the revised protection setpoints for Hi-Hi and Lo-Lo levels were properly implemented in the plant.

Operator Training

The inspector reviewed operator training lesson plans and training packages provided for operators and verified that training was provided which addressed changes involved with the new Babcock & Wilcox International (BWI) replacement steam generators. Training was performed for SG internal geometry changes, secondary piping reroutes, revised setpoints, normal operating procedures, and procedures for transients and accidents. An operations training instructor made a trip

to another facility which recently completed a steam generator replacement and incorporated startup testing results from the other plant into the Catawba training program. The inspector observed that prior to the SGRP outage the licensee performed a training and procedure self-assessment audit which was effective (OPS-01-96). During startup testing the licensee conducted "just in time" training for all the control room operating crews that would be on shift during load rejection testing. This training utilized the plant simulator to review the tests and to perform abnormal procedures that would be used. The inspector witnessed the "just in time" simulator training and observed that the control room crew effectively used the simulator to reperform the load rejections in several secondary plant configurations that were possible during power escalation activities.

c. Conclusions

The licensee's control and implementation of the startup testing program was effective. Hot gap measurement and visual leak inspection efforts were well coordinated and executed. Use of Plant Simulator to familiarize and review load rejection test procedures and expected plant response with control room shift crews prior to performing transient tests was good. Senior reactor operators and reactor operators demonstrated a proactive attitude during this training.

E1.5 Startup and Power Escalation Testing Observations

The inspectors periodically observed startup testing and power escalation activities in the Unit 1 control room from October 2 through October 10. These activities were performed with clear communication and good coordination between test personnel and control room shift crews. One exception to this performance involved coordination for the resolution of main steam flow indication discrepancies which resulted in unexpected level deviations in the A and B steam generators (PIP 1-C96-2723). The inspector reviewed and discussed the results of load rejection transient tests and SG level control system tests with responsible test engineers. Level stability was improved from the previous SGs and no tuning or modifications to the SG level control system were required as a result of the SG replacement. In addition, transient test data revealed that plant equipment responded properly. Overall, the licensee performed startup testing and power escalation testing activities well.

E1.6 Lower Containment Cleanliness and Housekeeping Controls

a. Inspection Scope (50001)

The inspectors reviewed Unit 1 lower containment housekeeping and material condition.

b. Observations and Findings

During the inspection period housekeeping conditions in the Unit 1 lower containment were observed to have declined. The inspector informed licensee management of these observations and the licensee subsequently formed an assessment team to perform a detailed walkdown of all areas in lower containment. The licensee documented results of the walkdown in PIP 1-C-96-2424. Numerous unattended articles, including tool bags, hard hats and used grinding disks were found throughout the lower containment areas during the walkdown. Some areas contained staged equipment that was not secured. Several main travel paths and ladder paths were observed to be cluttered with unnecessary equipment. The licensee also identified and corrected several workers using improper fall protection practices and several areas where grinding sparks were improperly controlled. From discussions with licensee management, the inspector discerned that the decline in lower containment housekeeping was apparently attributable to the installation of divider barriers between upper and lower containment which reduced access to the area. The inspectors subsequently performed independent walkdowns of the Unit 1 lower containment areas and verified that the licensee had corrected the housekeeping problems.

c. Conclusions

Unit 1 Lower Containment area housekeeping levels declined during this inspection period. The number of tools and miscellaneous equipment observed to be left in the lower containment areas increased, apparently as a result of physical access to the containment areas being reduced. The licensee increased attention to housekeeping and took appropriate actions following identification of the issues.

E1.7 Review of Overtime Records

a. Inspection Scope (50001)

The inspector reviewed overtime records to determine if TS administrative guidelines for control of working hours for SGRP personnel performing safety-related functions were met.

b. Observations and Findings

TS 6.2.2.f, Administrative Controls-Unit Staff, requires that administrative controls be developed and implemented to limit the working hours of station staff who perform safety-related functions. The inspector reviewed a sample of overtime records for SGRP personnel including engineering technical support personnel, welders, and welding QC inspectors. The inspector verified that overtime worked by personnel in this sample did not exceed TS guidelines. The inspector verified that Nuclear Site Directive 200, rev 3, Overtime Control, contained

administrative controls that implemented the guidelines of TS 6.2.2.f.

c. Conclusions

Required controls to limit working hours were implemented properly.

II Plant Support

R1 Radiological Protection and Chemistry Controls

R1.1 SG Replacement and Refueling Outage Radiation Protection Performance

a. Inspection Scope (50001)

The inspector reviewed the results of licensee's steam generator and refueling outage radiation protection performance based on ALARA goals and results for total radiation exposure, number of radiological events, and solid radwaste generation.

b. Observations and Findings

Total outage exposure received was 268 rem which was approximately 65% of the licensee's target goal of 434 rem. Exposure was categorized to account for dose received during SG replacement activities and routine refueling outage activities. SG replacement activities accounted for 168 rem (60% of the 300 rem target goal). Refueling outage activities accounted for 100 rem (89% of the 113 rem target). Similar results were achieved in the Solid Radwaste generation area with a total of 8320 cubic ft of waste generated (44% of target goal). 4326 cubic ft. were generated by SG replacement activities and 3994 cubic ft. were generated by refueling outage activities (34% and 66% of target goals, respectively). A total of 7 radiological events occurred which resulted in PIPs. This was 19% of the target goal of 48 events. 2 radiological events occurred during SG replacement activities and 5 events occurred during refueling outage activities (8% and 28% of target goals, respectively).

c. Conclusions

Radiation protection performance during the steam generator replacement outage was very good. The work was completed well under established radiation protection goals for steam generator replacement and outage activities. The licensee's efforts and implementation of a good shutdown crud burst, temporary shielding, and ALARA planning greatly contributed to the good performance.

III. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on October 17, 1996. The licensee acknowledged the findings presented. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

Anderson, J. QA, Welding
Benoit, R., SGRP Engineer
Cabe, D., Level III Examiner Radiography
Connell, K., SGRP Licensing Procurement Manager
Edwards, J., Welding Job Supervisor
Forbes, J., Engineering Manager
Freeman, C., Welding Technical Specialist
Hallman, G., SGRP Project Manager
Harbin, G., System Engineer
Kent, G., SGRP Licensing
Kitlan, M., Regulatory Compliance Manager
McCollum, W., Catawba Site Vice-President
McCurry, T., SGRP Engineer
Nicholson, K., Compliance Specialist
Patrick, M., Safety Assurance Manager
Peterson, G., Station Manager
Pitser, K., SGRP Engineer
Queenan, R., System Engineer
Schlise, L., SGRP Radiation Protection
Sharpe, R., SGRP Licensing
Sills, S., SGRP Site Manager
Stout, D., Engineering Supervisor
Tower, D., Compliance Engineer
Vandeven, T., Maintenance Engineer
Wiley, J., SGRP Engineer

INSPECTION PROCEDURES USED

IP 50001: Steam Generator Replacement Inspection

LIST OF ACRONYMS USED

ALARA - As Low As Reasonably Achievable
ASME - American Society of Mechanical Engineers
BB - Blowdown Recycle
BW - Wet Lay-Up
BWI - Babcock & Wilcox International
CA - Auxiliary Feedwater
CF - Feedwater
CFR - Code of Federal Regulations
CNS - Catawba Nuclear Station
FSAR - Final Safety Analysis Report
FTI - Framatome Technologies Inc.
IAE - Instrument and Electrical
IR - Inspection Report
MNS - McGuire Nuclear Station
NDE - Non-Destructive Examination
NRR - Office of Nuclear Reactor Regulation
PIP - Problem Investigation Process
QA - Quality Assurance
QC - Quality Control
RP - Radiation Protection
RT - Radiographic Testing
RVLIS - Reactor Vessel Level Indicating System
SG - Steam Generator
SGRP - Steam Generator Replacement Project
TS - Technical Specification
URI - Unresolved Item
WO - Work Order