UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
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ARLINGTON, TEXAS 76011-8064

May 17, 2000

William T. Cottle, President and
Chief Executive Officer
STP Nuclear Operating Company
P.O. Box 289
Wadsworth, Texas 77483

SUBJECT: NRC STEAM GENERATOR REPLACEMENT INSPECTION
REPORT NO. 50-498/00-02; 50-499/00-02

Dear Mr. Cottle:

This refers to the inspection conducted on January 24 through April 1, 2000, at the South Texas Project Electric Generating Station, Units 1 and 2, facility. The purpose of the inspection was to follow up on the activities related to the replacement of the Unit 1 steam generators. The enclosed report presents the results of this inspection.

Based on the results of this inspection, the NRC has determined that three Severity Level IV violations of NRC requirements occurred. These violations are being treated as noncited violations (NCVs), consistent with Section VII.B.1.a of the Enforcement Policy. These NCVs are described in the subject inspection report. If you contest the violation or severity level of these NCVs, 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, DC 20555-0001, with copies to the Regional Administrator, U.S. Nuclear Regulatory Commission, Region IV, 611 Ryan Plaza Drive, Suite 400, Arlington, Texas 76011; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the South Texas Project Electric Generating Station, Units 1 and 2, facility.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, its enclosure(s), and your response, if requested, will be placed in the NRC Public Document Room (PDR).

Should you have any questions concerning this inspection, we will be pleased to discuss them with you.

Sincerely,

/RA/

Joseph I. Tapia, Chief
Project Branch A
Division of Reactor Projects

Docket Nos.: 50-498
50-499
License Nos.: NPF-76
NPF-80

Enclosure:
NRC Inspection Report No.
50-498/00-02
50-499/00-02

cc w/enclosure:
T. H. Cloninger, Vice President
Engineering & Technical Services
STP Nuclear Operating Company
P.O. Box 289
Wadsworth, Texas 77483

S. M. Head, Supervisor, Licensing
Quality & Licensing Department
STP Nuclear Operating Company
P.O. Box 289
Wadsworth, Texas 77483

A. Ramirez/C. M. Canady
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, Texas 78704

M. T. Hardt/W. C. Gunst
City Public Service Board
P.O. Box 1771
San Antonio, Texas 78296

D. G. Tees/R. L. Balcom
Houston Lighting & Power Company
P.O. Box 1700
Houston, Texas 77251

Jon C. Wood
Matthews & Branscomb
One Alamo Center
106 S. St. Mary's Street, Suite 700
San Antonio, Texas 78205-3692

A. H. Gutterman, Esq.
Morgan, Lewis & Bockius
1800 M. Street, N.W.
Washington, D.C. 20036-5869

G. E. Vaughn/C. A. Johnson
Central Power & Light Company
P.O. Box 289
Mail Code: N5012
Wadsworth, Texas 77483

INPO
Records Center
700 Galleria Parkway
Atlanta, Georgia 30339-5957

Bureau of Radiation Control
State of Texas
1100 West 49th Street
Austin, Texas 78756

Jim Calloway
Public Utility Commission
William B. Travis Building
P.O. Box 13326
1701 North Congress Avenue
Austin, Texas 78701-3326

John L. Howard, Director
Environmental and Natural Resources Policy
Office of the Governor
P.O. Box 12428
Austin, Texas 78711-3189

Judge, Matagorda County
Matagorda County Courthouse
1700 Seventh Street
Bay City, Texas 77414

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U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket Nos.:	50-498 50-499
License Nos.:	NPF-76 NPF-80
Report No.:	50-498/00-02 50-499/00-02
Licensee:	STP Nuclear Operating Company
Facility:	South Texas Project Electric Generating Station, Units 1 and 2
Location:	FM 521 - 8 miles west of Wadsworth Wadsworth, Texas 77483
Dates:	January 24 through April 1, 2000
Inspectors:	Donald B. Allen, Project Engineer Neil F. O'Keefe, Senior Resident Inspector Gilbert L. Guerra, Resident Inspector Scott C. Schwind, Resident Inspector, Comanche Peak Claude E. Johnson, Senior Reactor Inspector Larry Ricketson, Senior Radiation Specialist Edwin H. Gray, Senior Reactor Inspector, Region I
Approved By:	Joseph I. Tapia, Chief, Project Branch A

ATTACHMENT: Supplemental Information

EXECUTIVE SUMMARY

South Texas Project Electric Generating Station, Units 1 and 2
NRC Inspection Report No. 50-498/00-02; 50-499/00-02

This inspection covered the activities related to the replacement of the Unit 1 steam generators. This inspection report included input from the resident inspectors and region based inspectors who performed onsite inspections in areas that included steam generator replacement project organization, work activities, lifting and rigging of heavy loads, cutting, welding and nondestructive testing, radiation protection, fire protection, and engineering support of these activities. This inspection report covers the period from January 24 to April 1, 2000. The end of the period coincides with the transition to the new revised reactor oversight program.

Engineering

- Inspections of current and planned work, including welding, nondestructive examination, related procedures, documentation, quality inputs, and progress of the Unit 1 steam generator replacement project disclosed generally good performance and identified no safety issues (Section E2.1).

- The planned engineered lifts of steam generators during the Unit 1 outage were well planned and executed. The use of engineered lifts was appropriate due to the load rating of the containment building polar crane and the use of special lifting devices to achieve the vertical clearance required to move steam generators inside containment. The requirements of the applicable ASME codes were met prior to and during these lifts. Procedures were appropriately established for controlling the lifting evolutions and performing the required inspections between lifts. The licensee established plant conditions which minimized the potential hazard from a dropped load (Section E2.2).

- The licensee's plans for monitoring for and responding to a buildup of argon gas from welding activities inside containment were initially incomplete. In response to inspectors' concerns, a workable response plan was developed; however, the licensee did not consider ventilating and mixing equipment as part of this effort. When a minimum ventilation lineup was determined, it was not communicated to control room operators who had the responsibility to implement it (Section E2.3).

- The licensee's project oversight of the steam generator replacement was facilitated by having a parallel organization between licensee and contractor personnel. Roles and responsibilities for each organization were clearly defined and closely followed. The training provided to both the project management and craft contractors was substantial and allowed for effective use of the licensee's regular processes. Nonconformance identification and reporting procedures for steam generator replacement issues were complex, but the licensee held coordination meetings to ensure that issues were properly screened and dispositioned (Section E6.1).

Plant Support

- The radiation protection department had been involved in all aspects of the steam generator replacement project and had prepared well for the steam generator replacement activities. Radiation protection personnel developed appropriate radiation

work permits, installed additional temporary shielding, supplemented their staff, and participated in mockup training. By using teledosimetry and video cameras for job coverage in high dose areas, radiation protection personnel were able to reduce their own dose without reducing the quality of support for work activities (Section R1.1).

- Radiation protection controls were effectively implemented. Radiation areas were posted and correctly controlled, radiation surveys were well conducted and recorded, and radiation protection personnel provided good job coverage. As a result of good radiation protection controls and a source term lower than anticipated, the total personnel dose was trending significantly below the projected value (Section R1.1).

- A violation of Technical Specification 6.8.1 was identified when three workers did not comply with radiation work permit requirements to attend the required mockup training. This violation is in the licensee's corrective action program as Condition Report 00-4618. This Severity Level IV violation is being treated as a noncited violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy (Section R1.1).

- The licensee found a high radiation area boundary rope and posting that had been moved so that they no longer served as an adequate barricade to prevent inadvertent access to the high radiation area. This was a violation of Technical Specification 6.12, which required that each high radiation area be barricaded and conspicuously posted. This violation is in the licensee's corrective action program as Condition Report 00-4790. This Severity Level IV violation is being treated as a noncited violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy (Section R1.1).

- The old steam generators removed from Unit 1 were transported to the onsite storage facility in a careful, controlled manner. Appropriate precautions were taken to avoid the spread of contamination and to minimize dose rates. A moving radiation area around the transporter was established and adequately controlled. The storage facility was designed to house the old steam generators until final dispositioning as part of final site decommissioning without causing a radiological hazard to the public (Section R1.2).

- The licensee failed to initiate a Transient Fire Load Permit when the actual fire load in the area exceeded an administrative limit. This was contrary to Technical Specification 6.8.1h, which applied to Procedure OPGP03-ZF-0019, "Control of Combustibles", Revision 1, and which required initiation of a Transient Fire Load Permit when combustible/flammable material quantities exceed 400 pounds of plastic, resin, rubber or 1000 pounds of wood or paper. This violation is in the licensee's corrective action program as Condition Report 00-1954. This Severity Level IV violation is being treated as a noncited violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy (Section F1.1).

Report Details

Summary of Plant Status

Unit 1 was operating at full power at the beginning of the inspection. The unit started coastdown operation on February 14 and was shut down on March 1 to refuel and replace steam generators. The unit remained shut down for the remainder of the inspection.

III. Engineering

E2 Engineering Support of Facilities and Equipment

E2.1 Steam Generator Replacement General Comments

a. Inspection Scope (50001)

Inspections were performed to obtain an overview of current and planned work, related procedures, documentation, quality inputs and progress of the Unit 1 steam generator replacement project (SGRP).

This inspection included a review of the preparations for welding and related nondestructive examination (NDE) of piping and other components, welder performance qualification and training, a sampling of the welding and NDE procedures, a sample of radiographs, the weld documentation process, and the work control instruction packages. Additional areas inspected included observation of the replacement steam generator staging area, walking the haul routes for both the replacement steam generators and old steam generators, observation of conditions inside the containment building, reviewing the involvement of Quality Assurance (QA) in project oversight, verifying the inclusion of input to SGRP replacement planning from industry experience, and assuring that operational plant water chemistry controls were in place for the replacement steam generators.

b. Observations and Findings

The preplanning and preparation for the SGRP was extensive. The project had a lessons learned input of approximately 1600 items from other similar projects that were considered and addressed in the planning process to avoid potential problems. When it was noted that the lessons learned data base did not include fire prevention or mitigation occurrences associated with replacement steam generator installation welding or flame cutting, project management initiated a review to fully consider these aspects.

The work control packages sampled were appropriate for the work tasks and provisions were in place to check and close out work control packages at the completion of work. A review of a sample of partially completed work packages identified no documentation problems. The QA attributes for performance monitoring surveillances of SGRP activities did not include an item to confirm that work packages were signed off for completed work and that signoffs for work steps represented work that was fully completed. A review of surveillance reports showed that the status of work packages signoffs had been a topic of QA review in the field and this attribute was included in the QA review scope for subsequent surveillances as of March 23, 2000.

The E10018 type welding electrode was selected for the manual welding of feedwater and auxiliary feedwater piping systems to steam generator nozzles. E10018 has a minimum as-deposited tensile strength of 100 KSI in comparison to the minimum of 70 KSI for E7018. However, the 100 KSI strength material is more subject to hydrogen induced cracking than the lower strength material. The inspectors reviewed the precautionary steps planned to prevent the occurrence of hydrogen induced cracking. The inspectors had questions regarding the adequacy of the electrode baking temperature and the postweld holding temperature. The SGRP project team was addressing the potential problems and was including appropriate precautionary steps in the finalized welding process controls. The inspectors noted that the welds would receive NDE by radiography, ultrasonic testing and magnetic particle inspection, which was adequate to detect problems in completed welds.

c. Conclusions

Inspections of current and planned work, including welding, nondestructive examination, related procedures, documentation, and quality inputs and progress of the Unit 1 steam generator replacement project disclosed generally good performance and identified no safety issues.

E2.2 Lifting and Rigging Activities During Steam Generator Replacement

a. Inspection Scope (50001)

The inspectors reviewed the licensee's activities performed to support multiple planned engineered lifts during removal and installation of steam generators in Unit 1. This included the polar crane analyses and testing in support of the lifts, as well as the special crane inspections to be performed in conjunction with each lift. The inspectors also observed portions of the lift of each of the old steam generators.

b. Observations and Findings

The inspectors reviewed the modification and testing of existing plant lifting equipment used in conjunction with the steam generator replacement project. The reactor containment building polar crane was the primary lifting device inside containment while a temporary runway and lifting device were constructed outside the containment equipment hatch in order to transfer steam generators between the equipment hatch and a specially designed trailer. Although the Unit 1 polar crane was originally procured as a 500 ton bridge crane, it was never load tested to 125 percent of this load. It was operationally tested during the installation of the original steam generators, which required a 484 ton lift. The subsequent load rating on the polar crane bridge was established at 417 tons. The maximum load on the bridge during the current steam generator replacement project was estimated to be approximately 615 tons. This consisted of a replacement steam generator (525 tons each), a temporary lifting device staged on the bridge rails (75 tons), and various rigging equipment (15 tons). Since this exceeded the rating of the crane bridge, the licensee intended to treat these lifts as planned engineered lifts in accordance with ASME B30.2-1996, "Overhead and Gantry Cranes." The inspectors reviewed Condition Report Engineering Evaluation 1996-2845-

11, which was performed in support of this and included an evaluation of the crane bridge by the original equipment manufacturer. It contained an adequate evaluation of the bridge construction as well as recommended inspections to be performed on the crane and a review of the crane's material history.

The polar crane trolley was rated at only 310 tons and could not provide adequate vertical clearance to lift the steam generators above the biological shield wall inside containment. For this reason, a temporary lifting device was installed on the bridge rails by a rigging subcontractor to perform this task. The temporary lifting device was considered "special designed equipment" and was appropriately tested to 110 percent of the anticipated load per ASME NQA-1-1994, Subpart 2.15, "Quality Assurance Requirements for Hoisting, Rigging, and Transporting Items for Nuclear Power Plants."

The inspectors reviewed the prerequisite conditions established prior to steam generator replacement activities inside the reactor containment building and determined that neither the requirements of plant Procedure OPGP03-0069, "Control of Heavy Loads", Revision 14, nor the recommendations made in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," were applicable. Prior to commencing these activities, the licensee had offloaded the core to the spent fuel pool and isolated the pool from the containment building by closing the fuel transfer tube valve and by installing the gate between the pool and the transfer canal in the fuel storage building. Therefore, there was no concern for damage to fuel from a postulated heavy load drop inside containment. Furthermore, the licensee isolated component cooling water to the containment building in order to preclude a loss of spent fuel pool cooling, which could result from a severed component cooling water pipe caused by a heavy load drop. No other systems inside containment were required to be operable in order to maintain safe shutdown or decay heat removal.

No formal analysis was performed which considered the potential for an airborne release in excess of 10 CFR Part 100 limits caused by a postulated heavy load drop inside containment. However, the inspectors concluded that there was little potential for this due to the lack of a large source of activity inside containment and the load paths to be followed while moving steam generators.

Lifting and rigging procedures for the steam generator replacement were provided primarily by a subcontractor which also supplied and operated the lifting equipment. These procedures were reviewed and incorporated into the work packages per plant procedures. The inspectors reviewed a portion of the procedures, including the special inspections to be performed on the polar crane bridge before and after each lift. The inspections were recommended by the manufacturer in support of the planned engineered lift. These were comprehensive and included inspection points for known failures and degraded conditions on the polar crane bridge. They also appropriately addressed critical welds and bolted joints which would receive the highest stresses during the lifts.

The inspectors observed portions of lifting evolutions for each old steam generator. The lifting evolutions were slow, well controlled, and accomplished without incident. The inspectors noted that, while down-ending old Steam Generator 1B onto the trolley carts

on the runway leading out of the containment equipment hatch, the licensee did not reinstall runway stops. Condition Report Engineering Evaluation 96-2845-12 stated that the runway extension inside the bio-shield was not designed to support a steam generator load, so runway stops would be installed to prevent loading the runway. The licensee found that the lifting and rigging subcontractor had placed the provision in procedures for on-loading and up-ending new steam generators, but not down-ending of the old steam generators. Condition Report (CR) 00-5425 was written to correct the applicable procedures.

c. Conclusions

The planned engineered lifts of steam generators during the Unit 1 outage were well planned and executed. The use of engineered lifts was appropriate due to the load rating of the containment building polar crane and the use of special lifting devices to achieve the vertical clearance required to move steam generators inside containment. The requirements of the applicable ASME codes were met prior to and during these lifts. Procedures were appropriately established for controlling the lifting evolutions and performing the required inspections between lifts. The licensee established plant conditions which precluded any potential hazard from a dropped load.

E2.3 Inert Gas Protection Inside Containment

a. Inspection Scope (50001)

The inspectors reviewed the licensee's plans for installing argon gas lines and for monitoring containment atmosphere quality as part of a review of temporary services for the outage. Argon, an inert gas, was used to support both automatic and manual gas tungsten arc welding. Because it is heavier than air, a buildup of argon in the lower levels of containment had the potential to displace air and present a personnel safety hazard.

b. Observations and Findings

The licensee installed four oxygen sensors at the lowest level of containment to provide a readout and alarm if unsatisfactory conditions developed. The alarm would sound in a tool issue area which was continuously manned. A worker would then be dispatched to confirm the atmosphere readings with portable equipment. A conservative action level was established to begin an evacuation of the lower two levels of containment and secure the use of argon gas inside containment until the source of the buildup could be located.

The inspectors noted that the licensee did not have a clear response plan until the inspectors inquired. Once a plan was created, it was improved a number of times as different work groups, most notably operations, requested changes. The plan was adequate as a response tool when it was completed; however, it did not clearly delineate what minimum ventilation and mixing systems were required to be in operation while argon was being used. Without constant mixing and a fresh air supply, welding activities had the potential to cause an accumulation of argon gas. Although the

licensee determined the minimum ventilation and mixing equipment that was required to be in operation in response to inspectors' questions, the inspectors determined that control room operators were not aware of the minimum ventilation equipment lineup. This information was eventually provided to the operators.

The inspectors observed the oxygen monitors and discussed the system function and response responsibilities with tool issue personnel. The system was appropriately installed, and personnel were familiar with its operation and with their roles.

c. Conclusions

The licensee's plans for monitoring and responding to a buildup of argon gas from welding activities inside containment were initially incomplete. In response to inspectors' concerns, a workable response plan was developed; however, the licensee did not consider ventilating and mixing equipment as part of this effort. When a minimum ventilation lineup was determined, it was not communicated to control room operators who had the responsibility to implement it.

E6 Engineering Organization and Administration

E6.1 Contractor Oversight and Nonconformance Dispositioning

a. Inspection Scope (50001)

The inspectors discussed the division of responsibilities and organization for the SGRP with the project managers for the licensee and the principle contractor. Bechtel's Engineering Department Project Instruction for Nonconformance Reports, Revision 2, was also reviewed.

b. Observations and Findings

b.1 Organization and Contractor Oversight

The licensee and Bechtel established an organization that provided parallel functions. The two organizations were closely matched and counterparts were co-located to ensure maximum cooperation and integration. Individual responsibilities were assigned in detail by contract.

Project oversight by the licensee was implemented through the dual organization. The core project engineering and planning staffs were manned 3 years in advance of the project, allowing for planning in detail. Senior licensed operators were included in the core team to provide an operations perspective from the beginning of the project. Other support organizations, such as health physics and security, became involved more than a year before the outage. The SGRP group studied industry experience and observed a number of other facilities that were undergoing steam generator replacements.

All work for the SGRP was planned and controlled using the normal station processes. Work packages provided by the contractor were reviewed, approved, and integrated into the regular outage schedule by station personnel. Work start authority was also in accordance with normal station processes. Contractor personnel received training on the applicable station processes and computer systems to facilitate this practice. This approach allowed an outage schedule which contained all work activities for the entire outage, rather than separate schedules for the SGRP activities and the regular outage scope.

Oversight of engineering and project management activities was accomplished through the integrated organizational structure. Issues were jointly discussed and assigned to the most capable group. This method was effective in keeping issues in the open. Oversight of craft personnel was performed by Bechtel and monitored by the licensee. The licensee planned an active campaign of quality oversight of SGRP activities. The licensee assigned eight personnel from the QA group specifically to perform around the clock coverage of SGRP activities in a wide variety of focus areas. The licensee's QA department was supplemented with contractors familiar with South Texas Project processes in order to staff this shift schedule. This was intended to provide a second check of the quality control measures being performed by Bechtel personnel.

The licensee reviewed the qualifications and training of Bechtel quality control personnel and then certified these individuals in accordance with their program.

b.2 **Contractor Training**

The licensee provided training for contractors on a wide variety of topics. In addition to the basic general employee training, the licensee committed substantial resources to training contractors in the implementation of station processes. This was intended to fully integrate project contractors into the process. Additionally, familiarity training was provided to a wide audience of station and contractor personnel so that the scope of the work was understood by all work groups. Specific craft personnel received site certification training where applicable.

The inspectors noted that senior licensee management provided clear expectations intended to avoid problems assimilating contractors with minimal nuclear plant outage experience. The approach was to provide a buddy system and additional on-the-job training to ensure that newer people had adequate guidance readily available. Radiation protection technicians were instructed to proactively help workers who appeared to be unfamiliar with the processes. The inspectors noted that these efforts were largely effective in avoiding typical problems with new people during the outage.

The licensee provided a number of mockup trainers to allow familiarity, practice, and work practice refinement. These mockup trainers had the added benefit of reducing dose during actual work. The inspectors observed a number of practice sessions and noted that the licensee made excellent use of the high quality mockups.

b.3 **Disposition of Nonconformances**

The inspectors determined that the SGRP's process for identifying and dispositioning nonconformances was similar to the process normally used by the licensee. Bechtel used nonconformance reports (NCRs) to report and track action on nonconformances within the scope of the contractor's work authority. Field change requests (FCRs) were used to initiate changes in work documents. Any issues which required action within the licensee's control, or which were not specifically part of the contractor's work scope, would be tracked in a CR. Bechtel personnel received training in the implementation of the CR system. Any item that had actions in both systems was required to be appropriately cross-referenced in both systems. Additionally, each NCR and FCR was required to be posted against the applicable work document to ensure proper disposition before the work document could be closed.

The licensee developed a matrix to clarify which system should be used to disposition different types of issues. Daily joint meetings were scheduled between the licensee and Bechtel to track the status of open NCRs, FCRs, and CRs to ensure both timely disposition and proper ties to project milestones and plant mode changes. Both CRs and NCRs received screening by senior licensed operators to ensure proper operability and reportability determinations, as well as tracking for mode change restraints. This joint screening process was effective in determining the significance of issues and in assigning the issues to the appropriate process. The inspectors observed that the screening was frequently quite conservative in assigning due dates and mode change restraints.

c. Conclusions

The licensee's project oversight of the steam generator replacement was facilitated by having a parallel organization between licensee and contractor personnel. Roles and responsibilities for each organization were clearly defined and closely followed. The training provided to both the project management and craft contractors was substantial and allowed for effective use of the licensee's regular processes. Nonconformance identification and reporting procedures for steam generator replacement issues were complex, but the licensee held coordination meetings to ensure that issues were properly screened and dispositioned.

IV. Plant Support

R1 Radiological Protection and Chemistry Controls

R1.1 Radiological Practices

a. Inspection Scope (50001)

Radiation protection activities were reviewed by the resident inspectors and a regional specialist. The inspectors interviewed radiation protection personnel and reviewed radiation protection planning, staffing, and training in preparation for steam generator

replacement activities. The inspectors also observed radiological controls during outage activities and reviewed radiation dose results.

b. Observations and Findings

In preparation for the outage, the licensee reviewed industry experience and lessons learned from previous steam generator replacements, collected an extensive amount of information related to radiation dose results, and compiled a list of site-specific items that would contribute to extra dose. From a list of the tasks necessary to accomplish the steam generator replacement and site-specific dose information, the licensee developed radiation work permits to address the tasks. The inspectors reviewed selected examples of radiation work permits and found that they provided radiation protection instructions and precautions commensurate with the radiation hazards associated with the work activities.

During previous refueling outages, the licensee typically installed 12,000 to 15,000 pounds of temporary shielding to reduce radiation dose rates. To prepare for steam generator removal, the licensee installed approximately 90,000 pounds of temporary shielding. The increased shielding, along with a source term lower than anticipated, reduced the general area dose rates around the steam generator components by approximately 50 percent. The inspectors observed temporary shielding and verified that it was installed in accordance with procedural requirements and was evaluated for weight loading of the plant components.

Radiation protection personnel provided excellent support of outage activities. Radiation protection was well-staffed with qualified technicians and decontamination personnel to support the large amount of work associated with steam generator replacement. The licensee supplemented the radiation protection staff with contract personnel and radiation protection personnel from other nuclear power plant sites. The inspectors reviewed selected resumes of contract radiation protection technicians and verified that senior technicians met qualification requirements.

To handle the increased traffic flow into the radiological controlled area, the licensee established an alternate access point to help members of the expanded work force enter and exit the radiological controlled area successfully. The licensee installed additional personnel contamination monitors and small article monitors. The inspectors observed workers accessing and exiting the work areas and noted that radiation protection personnel responded quickly to personnel contamination monitor alarms and workers needing to have items surveyed for release from the radiological controlled area.

Contamination control was excellent. Despite the heavy industrial activities inside containment and the large number of workers, radiation protection personnel were able to maintain the areas of the reactor containment building outside the bioshield free of contamination. The number of personnel contamination events remained well below expected levels.

The licensee developed a number of devices which helped during radiological jobs. One example was a template used to standardize the radiological survey locations on

primary pipe ends. Another was a rotating viewing window fitted to a high efficiency particulate air suction hose which allowed reactor coolant system pipe end weld preparations to be performed without spreading contamination and without using respirators. The licensee also used state of the art decontamination methods for the primary piping.

Extensive use of video equipment was evident. The radiation protection control point for work inside the bioshield used a significant number of remote cameras with excellent clarity. The use of radio communications between workers and radiation protection technicians allowed remote monitoring of some high dose jobs with the ability to summon radiation protection technicians when coverage was required, thus saving dose to radiation protection personnel. In addition, radiation protection personnel installed remote dosimeters during some jobs to provide continuous dose information to the control point, reducing the radiation protection personnel dose further.

The licensee tracked personnel radiation dose with electronic dosimeters. A radiation protection representative routinely reported the results as part of the plant status meetings. Each work shift, ALARA representatives reviewed the personnel dose accrued by each radiation work permit to determine if additional dose controls were necessary.

The ALARA Review Committee conducted a meeting on March 16, 2000, to review the outage dose status. The licensee originally projected that steam generator replacement would result in a dose of approximately 205 rems. This projection was based, in part, on the dose rates observed during the previous Unit 1 refueling outages. However, the source term was less than the licensee anticipated, and the total dose at the time of the ALARA Review meeting was much less than the dose projected for that point in the outage. As a result, the licensee lowered the projected dose to approximately 154 rems. Based on a comparison with steam generator replacement results at similar plants, the new dose goal represented good ALARA performance.

The licensee removed the primary bowl drain lines from the old steam generators at the beginning of the outage. This was done to eliminate four high radiation areas in major work locations. The inspectors attended the ALARA briefing conducted before workers severed the bowl drain line on Steam Generator C. The briefing included a discussion of the requirements of the applicable radiation work permit and provided the workers with a comprehensive knowledge of potential radiological hazards and methods to reduce radiation dose.

The licensee provided extensive mockup training to workers who were to be involved in risk significant activities. The training, combined with radiation work planning and controls, produced good ALARA results. For example, the inspectors observed portions of the steam generator bowl drain removal work and noted that the tasks were conducted swiftly and efficiently. The workers accrued a lower total radiation dose than was projected.

While reviewing the implementation of exposure controls, the inspectors confirmed through independent measurements and observations that areas were posted and

controlled correctly, that radiation surveys were properly conducted and recorded, and that personnel dosimetry was positioned as required. Radiation protection technicians were easy to identify because they wore vests that were unique to their department. The inspectors interviewed radiation protection technicians and determined that they were knowledgeable of ongoing work activities and potential radiological hazards.

Despite the overall good results from the radiation protection controls, the inspectors identified a problem related to radiation work permit use. Technical Specification 6.8.1 requires that the licensee implement procedures that are listed in Appendix A of Regulatory Guide 1.33, Revision 2, February 1978. One of the procedures listed in Appendix A, Section 7.e (1), is for a radiation work permit system. To meet this requirement, the licensee implemented Procedure 0PGP03-ZR-0051, “Radiological Access and Work Control,” Revision 11. Section 4.4.2 of this procedure required that workers review and comply with applicable radiation work permits. Section 6.1.1 of the procedure also required that individuals attend prejob meetings and mockup training, as applicable. Radiation Work Permit 2000-1-0153 required workers to have mockup training before participating in steam generator bowl drain removal activities. By comparing a list of individuals who used Radiation Work Permit 2000-1-0153 with the mockup training attendance lists, the inspectors identified individuals who did not comply with this requirement. Specifically, three individuals who participated in steam generator bowl drain removal activities on March 12, 2000, used Radiation Work Permit 2000-1-0153 without first attending the required mockup training. The failure to comply with the radiation work permit instructions was a violation of procedural requirements and Technical Specification 6.8.1. This Severity Level IV violation is being treated as a noncited violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy. This violation is in the licensee’s corrective action program as Condition Report 00-4618 (NCV 50-498/0002-01).

The inspectors noted some minor examples of poor radiation worker practices, such as workers handling metal cuttings with rubber gloves rather than using an outer leather glove, personnel forgetting electronic dosimeters, improper removal of protective clothing, and workers sitting in areas that were not designated as low dose waiting areas. However, these practices were quickly corrected by the radiation protection staff.

On March 17, 2000 licensee representatives found a high radiation area boundary rope and posting that had been moved so that they no longer served as an adequate barricade to prevent inadvertent access to the high radiation area. Originally, the rope barricade at the 19-foot elevation Steam Generator D access ladder was tied to supports approximately 4 feet above the floor. When licensee representative identified the problem, the rope barricade had been raised to approximately 6 feet off the floor and did not serve as an adequate barrier. The failure to adequately barricade the high radiation area was a violation of Technical Specification 6.12, which required that each high radiation area be barricaded and conspicuously posted. This violation is in the licensee’s corrective action program as CR 00-4790. This Severity Level IV violation is being treated as a noncited violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy (NCV 50-498/0002-02).

c. Conclusions

The radiation protection department had been involved in all aspects of the steam generator replacement project and had prepared well for the steam generator replacement activities. Radiation protection personnel developed appropriate radiation work permits, installed additional temporary shielding, supplemented their staff, and participated in mockup training. By using teledosimetry and video cameras for job coverage in high dose areas, radiation protection personnel were able to reduce their own dose without reducing the quality of support for work activities.

Radiation protection controls were effectively implemented. Radiation areas were posted and correctly controlled, radiation surveys were well conducted and recorded, and radiation protection personnel provided good job coverage. As a result of good radiation protection controls and a source term lower than anticipated, the total personnel dose was trending significantly below the projected value.

A violation of Technical Specification 6.8.1 was identified when three workers did not comply with radiation work permit requirements. This violation is in the licensee's corrective action program as Condition Report 00-4618. This Severity Level IV violation is being treated as a noncited violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy.

The licensee found a high radiation area boundary rope and posting that had been moved so that they no longer served as an adequate barricade to prevent inadvertent access to the high radiation area. This was a violation of Technical Specification 6.12 which required that each high radiation area be barricaded and conspicuously posted. This violation is in the licensee's corrective action program as Condition Report 00-4790. This Severity Level IV violation is being treated as a noncited violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy.

R1.2 Transport and Storage of the Old Steam Generators

a. Inspection Scope (50001)

The inspectors reviewed the licensee's 50.59 evaluation for the old steam generator storage facility, Unreviewed Safety Question Evaluation 98-0012, Revision 0. The inspectors also reviewed the haul route documents, Health Physics Activity Plan HPAP-005, "Moving the Old Steam Generators from the Reactor Containment Building to the Old Steam Generator Storage Facility," Revision 0, and Radiation Protection Standing Order 4-3, "Routine Survey Requirements, Expectations, and Task Forms." The inspectors observed transport of the first old steam generator from the containment to the storage facility.

b. Observations and Findings

The licensee constructed a new building as a storage vault for the old steam generators from both units. The storage vault will be sealed and remain inaccessible until final dispositioning of the steam generators as part of final decommissioning of the site.

The inspectors observed that the building was constructed so that there were no sources of fire hazards or potential for internal flooding. The building was designed to withstand external flooding and tornado loading. Calculations were performed which demonstrated that no radiological hazard to the public would exist if extraordinary flood levels were experienced or if the roof collapsed onto the old steam generators due to a seismic event. The licensee established periodic survey requirements for the outside of the old steam generator storage facility and installed appropriate radiological postings on the building. Initial survey results were consistent with predictions.

The licensee's radiation protection plan for moving the old steam generators to the storage facility was detailed and included specific estimates for dose rates and contamination levels. The steam generators were decontaminated and then coated to prevent the spread of contamination. All openings were seal welded and the primary nozzles were shielded to reduce dose rates. The steam generators were transported using a moving radiation area in which radiation protection technicians performed continuous surveys while acting as human barriers. The plan included contingencies to ensure proper posting of the area around the transporter in the event that the movement was interrupted. The old steam generators were placed into storage in a way that minimized dose while placing subsequent steam generators into the storage facility.

The transportation of Steam Generator D to the storage facility was slow, well controlled, and uneventful with one exception. A portion of the road directly in front of the storage facility failed as the steam generator was moved into the building. This was repaired and the move was completed without further event.

c. Conclusions

The old steam generators removed from Unit 1 were transported to the onsite storage facility in a careful, controlled manner. Appropriate precautions were taken to avoid the spread of contamination and to minimize dose rates. A moving radiation area around the transporter was established and adequately controlled. The storage facility was designed to house the old steam generators until final dispositioning as part of site final decommissioning without causing a radiological hazard to the public.

F1 Control of Fire Protection Activities

F1.1 Control of Combustible Material (64704)

The inspectors found that, in general, the licensee was controlling combustible material satisfactorily. During a plant tour, the inspectors requested combustible loading permits for several areas such as the Unit 1 electrical auxiliary building cable spreading Room 302 and hallway Room 308 (temporary containment hallway access to the radiological access) on the 60 foot elevation. A fire load permit had not been posted for the areas in question. Upon further review the licensee found that the combustible loading in those areas had exceeded the administrative limit of 400 pounds of plastic/rubber or 1000 pounds of paper/wood. The actual loading was 675 pounds of plastic/rubber and 600 pounds of paper/wood. Although this did not exceed the design limit, the actual loading was 95 percent of the design limit of 80,000 BTU/ft2 listed in the STP Fire Hazard

Analysis Report. The fire protection engineer had identified this deficiency on February 7, 2000, but no action had been implemented to correct the deficiency. This condition existed from January 27 to February 14, 2000, when the inspectors requested the information. The licensee initiated CR 00-1954. After the deficiency was placed into the licensee's corrective action program, it was corrected on February 15, 2000. The inspectors determined that, because the combustible loading did not exceed the design limit, the safety significance was minimal.

Technical Specification 6.8.1h requires that written procedures be established, implemented, and maintained covering Fire Protection Program implementation activities. Technical Specification 6.8.1h applies to Procedure OPGP03-ZF-0019, "Control of Combustibles", Revision 1. Procedure OPGP03-ZF-0019, step 4.4.1, requires "Foremen/supervisors or other responsible individuals shall initiate a Transient Fire Load Permit (Form 1) to identify transient fire loads that are taken into safety-related areas, as required by step 4.2.1.1. Step 4.2.1.1 states that "A Transient Fire Load Permit is required when combustible/flammable material quantities per work group, per work activity exceed the quantities as listed in Addenda 3 & 4." Addendum 4 limits are 400 pounds of plastic, resin, or rubber or 1000 pounds of wood or paper. Contrary to the above, the licensee failed to initiate a Transient Fire Load Permit when the actual load in the area exceeded an administrative limit. This Severity Level IV violation is being treated as a noncited violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy (NCV 50-498/0002-03).

V. Management Meetings

X1 Exit Meetings Summary

The inspectors presented the inspection results to members of licensee management on February 18, March 7, March 23, and April 4, 2000. Management personnel acknowledged the findings presented. The inspector asked whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

ATTACHMENT

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee
W. Bullard, Supervisor, Health Physics
T. Cloninger, Vice President, Generation
K. Coates, Manager, Maintenance
E. Halpin, Manager, Operations
W. Harrison, Licensing Engineer
S. Head, Supervisor, Licensing
M. Kanavos, SGRP Engineering Manager
A. Kent, Manager, Electrical/Instrumentation and Controls, Systems Engineering
R. Lovell, Manager, Training/Outage Director
B. MacKenzie, Manager, Operating Experience Group
M. McBurnett, Director, Quality and Licensing/Outage Director
G. Parkey, Plant General Manager
G. Powell, Manager, Health Physics
D. Rencurrel, Manager, Electrical/Instrumentation and Controls/Outage Director
K. Richards, SGRP Implementation Manager
P. Serra, Manager, Plant Protection
J. Sheppard, Vice President, Engineering and Technical Services
G. Simmons, Supervisor, Health Physics
S. Thomas, Manager, Design Engineering Department
M. Van Noy, Licensing Engineer

INSPECTION PROCEDURES USED

IP 50001: Steam Generator Replacement Inspection
IP 64704: Fire Protection Program

DOCUMENTS REVIEWED

Health Physics Project Plan 1RE09

Steam Generator Replacement Project 1RE09 Health Physics Handbook

Health Physics Activity Plan HPAP-005, Moving the Old Steam Generators from the Reactor Containment Building to the Old Steam Generator Storage Facility, Revision 0

Radiation Protection Standing Order 4-3, Routine Survey Requirements, Expectations, and Task Forms

Bechtel's Engineering Department Project Instruction for Nonconformance Reports, Revision 2

ALARA Review 1-2000-002, "Steam Generator Replacement"

ALARA Review 1-2000-002 Addendum 3, Steam Generator Replacement - Sever Plug OSG Channel Head Drains

ALARA Review Committee - 1RE09 In Process Review - 3/16/2000

0PGP03-ZF-0019	Control of Combustibles, Revision 1
0PGP03-ZR-0048	Personnel Dosimetry Program, Revision 5
0PGP03-ZR-0069	Control of Heavy Loads, Revision 14
0PRP04-ZR-0013	Radiological Survey Program, Revision 7
0PRP07-ZR-0004	Temporary Shielding, Revision 3
0PRP07-ZR-0011	Radiological Work ALARA Reviews, Revision 3

ITEMS OPENED AND CLOSED

Opened

50-498/0002-01	NCV	Three individuals used a radiation work permit without attending the required mockup training (Section R1.1).
50-498/0002-02	NCV	Boundary rope and posting moved so that they no longer served as an adequate barricade to prevent inadvertent access to the high radiation area (Section R1.1)
50-498/0002-03	NCV	Failure to initiate a Transient Fire Load Permit where the actual load in the area exceeded an administrative limit (Section F1.1).

Closed

50-498/0002-01	NCV	Three individuals used a radiation work permit without attending the required mockup training (Section R1.1).
50-498/0002-02	NCV	Boundary rope and posting moved so that they no longer served as an adequate barricade to prevent inadvertent access to the high radiation area (Section R1.1)
50-498/0002-03	NCV	Failure to initiate a Transient Fire Load Permit where the actual load in the area exceeded an administrative limit (Section F1.1).