U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket/ Report No.	50-213/93-22
License No.	DPR-61
Licensee:	Connecticut Yankee Atomic Power Company (CYAPCo) P. O. Box 270 Hartford, CT 06141-0270
Facility:	Haddam Neck Plant
Location:	Haddam Neck, Connecticut
Dates:	December 12, 1993 to January 15, 1994
Inspectors:	William J. Raymond, Senior Resident Inspector Peter J. Habighorst, Resident Inspector Jason Jang, Senior Radiation Specialist
Approved by:	L. Doerflein, Chief Reactor Projects Section No. 4A Date: 2/24/94

Areas Inspected: NRC resident inspection of plant operations, maintenance, engineering and technical support and plant support activities. As an initiative, the inspector evaluated CYAPCo's actions in response to NRC Information Notice 92-16.

Results: See Executive Summary

EXECUTIVE SUMMARY

HADDAM NECK PLANT INSPECTION 50-213/93-22

Plant Operations

Safe facility operation was noted throughout the period. Inspector observation of operator actions during two Unusual Event emergencies noted good adherence to procedures and license conditions. Except for a delay in securing from the volume control tank venting operation, the inspector noted good operator action to recover from an unplanned, but monitored radioactive gas release. The probable cause for the release was a malfunction of the mechanical relief valve on the waste gas surge tank. NRC review will follow CYAPCo actions to complete the root cause evaluation **(IFI 93-22-01)**.

CYAPCo has a program to assure the proper operation of heat trace circuits that prevent boric acid precipitation and provide freeze protection for process piping. This program is working very well for systems that are safety related and important to safety. However, problems have occurred in providing continuous freeze protection for some balance of plant and radwaste systems. Some design deficiencies exist. Plant management has an initiative to improve the program. NRC review confirmed that programmatic weaknesses exist, which include a failure to correct all deficiencies prior to the start of cold weather, insufficient engineering justification for thermostat setpoints, poor heat trace conditions in the new tank farm, and insufficient follow-up of past modifications to correct known problems. Additional NRC review will track licensee actions to address these issues **(IFI 93-22-02)**.

Inspector review of three historical events involving mispositioned valves in non-safety related systems identified no causal linkage for the issues. Licensee action in this area will be reviewed as part of the followup of a past inspection item.

Maintenance

The inspector determined that maintenance and surveillance activities observed during the period were acceptably performed and in accordance with administrative requirements. Good pre-job briefings and planning minimized the time the plant was in the limiting condition for operation for containment integrity during flushing and calibration of service water differential pressure instruments.

Engineering and Technical Support

In response to questions by the Nuclear Review Board, the licensee concluded that degraded air flows in the containment air recirculation (CAR) fans identified in May 1993, constituted an inoperable condition, and thus was reportable. This conclusion reversed a prior determination that the period of inoperability occurred at the time of discovery. An

engineering evaluation concluded that CAR fan safety function was not compromised in spite of the degraded flows. This item is open pending submittal of the licensee event report, and subsequent review by the NRC **(IFI 93-22-03).**

Licensee inspections identified degradation in the boron carbide plates used in the surveillance coupons for the spent fuel pool storage racks. The licensee evaluated the racks in light of the coupon degradation and demonstrated adequate margin exists to the criticality design basis. CYAPCo actions to address the degradation in the poison material is open **(IFI 93-22-04)**. CYAPCo's actions in regard to NRC Information Notice 92-16 were appropriate and supported refueling activities in 1993.

Safety Assessment/Quality Verification

The Nuclear Review Board critically evaluated a historical reportability evaluation. The review prompted plant management to reverse a previous reportability determination regarding the containment air recirculation fan air flows.

TABLE OF CONTENTS

1.0 SUMMARY OF FACILITY ACTIVITIES 1

2.0 PLANT OPERATIONS (71707, 71714 and 93702) 1
- 2.1 Operational Safety Verification 1
- 2.2 Rod Position Indication Failure - Unusual Event 2
- 2.3 Unplanned Radioactive Gas Release - Unusual Event (IFI 93-22-01) 3
- 2.4 Cold Weather Preparations (IFI 93-22-02) 8
- 2.5 Mispositioned Valves 12

3.0 MAINTENANCE (61726 and 62703) 14
- 3.1 Maintenance Observation 14
  - 3.1.1 Rod #36 Position Indication 14
  - 3.1.2 Bypass Jumper 93-006 For Rod #36 Position Indication 15
  - 3.1.3 Shutdown Bank "D" Position Indication 15
  - 3.1.4 PMP 9.2-177, Car Fan Cooling Testing 16
- 3.2 Surveillance Observation 17
  - 3.2.1 Auxiliary Feed Pump (P-32-1A) Functional Test 17
  - 3.2.2 CAR Fan Testing 17
  - 3.2.3 Auxiliary Steam Generator Feed Pump Test 17
  - 3.2.4 Emergency Core Cooling Systems Test 18
  - 3.2.5 Spent Fuel Rack Boron Carbide (B_4C) Plate Inspection 18

4.0 ENGINEERING AND TECHNICAL SUPPORT (71707) 19
- 4.1 Reporting Containment Air Recirculation Fan Failures (IFI 93-22-03) . . 19
- 4.2 Loss of Boron in Spent Fuel Rack Sample Coupons (IFI 93-22-04) 20

5.0 PLANT SUPPORT (40500, 71707, 90712, and 92701) 23
- 5.1 Radiological Controls 23
- 5.2 Plant Operations Review Committee 23
- 5.3 Review of Written Reports 23
- 5.4 Follow-up of Previous Inspection Findings 24
- 5.5 NRC Information Notice 92-16: Loss of Flow From Residual Heat Removal Pump During Refueling Cavity Draindown 25

6.0 EXIT MEETINGS 25

Note: The NRC inspection manual procedure or temporary instruction (TI) that was used as inspection guidance is listed for each applicable report section.

DETAILS

1.0 SUMMARY OF FACILITY ACTIVITIES

The unit was operating at full power on December 12. Routine power operations continued throughout the inspection period until January 13. Plant operators declared an Unusual Event and began a load reduction starting at 5:00 a.m. on January 13 after the position indications for three rods in shutdown bank "D" were declared inoperable. The load reduction was halted at 6:30 p.m. at 72% rated power after plant personnel corrected a loose wire in the position indication circuitry. While recovering from this event and with the reactor at 80% rated power, the operators declared a second Unusual Event at 8:15 a.m. after discovering and terminating an unplanned release of radioactive gas from the waste gas system. The release to the environs was monitored and was well below regulatory limits. Plant operation at full power resumed at 8:48 p.m. on January 13. Routine operation at full power continued until the end of the period on January 15.

On December 22, the NRC Region I Administrator toured the facility and met with station personnel and management. The discussion topics included management changes, reorganization of engineering groups, outage performance, cost reduction measures, department initiatives and major challenges, and a discussion with the quality service department director on recent activities.

2.0 PLANT OPERATIONS (71707, 71714 and 93702)

In addition to normal utility working hours, the review of plant operations was routinely conducted during portions of backshifts (evening shifts) and deep backshifts (weekend and night shifts). Inspection coverage was provided for twenty-two hours during backshifts and twelve hours during deep backshifts.

2.1 Operational Safety Verification

This inspection consisted of selective examinations of control room activities, operability reviews of engineered safety feature systems, plant tours, review of the problem identification systems, and attendance at periodic planning meetings. Control room reviews consisted of verification of staffing, operator procedural adherence, operator cognizance of control room alarms, control of technical specification limiting conditions of operation, and electrical distribution verifications. Administrative control procedure (ACP) - 1.0-23, "Operations Department Shift Staffing Requirements," identifies the minimum staffing requirements. During the inspection period, these requirements were met.

The inspectors reviewed the onsite electrical distribution system to verify proper electrical line-up of the emergency core cooling pumps and valves, the emergency diesel generators, radiation monitors, and various engineered safety feature equipment. The inspectors also verified valve lineups, position of locked manual valves, power supplies, and flow paths for

the high pressure safety injection system, the low pressure safety injection system, the containment air recirculation system, the service water system, and the emergency diesel generators. No deficiencies were noted.

Jumpers

Bypass jumpers were reviewed against the requirements of ACP 1.2-14.1, "Jumper, Lifted Lead and Bypass Control NEO 8.05," with emphasis on proper installation and the content of the safety evaluations. The inspector reviewed all jumpers for age, and verified that Plant Operations Review Committee (PORC) evaluations were completed to disposition longstanding evaluations. The jumpers reviewed were found to be in accordance with administrative requirements.

Log-Keeping and Turnovers

The inspectors reviewed control room logs, night order logs, plant incident report logs, and crew turnover sheets. No discrepancies or unsatisfactory conditions were noted. The inspectors observed crew shift turnovers and determined they were satisfactory, with the shift supervisor controlling the turnover. Plant conditions and evolutions in progress were discussed with all members of the crew. The information exchanged was accurate.

During attendance at daily planning meetings, the inspector noted discussions were held on maintenance and surveillance activities in progress, and on work control and authorization. The inspectors conducted periodic plant tours in the primary auxiliary building, turbine building, and intake structures. Plant housekeeping was satisfactory, except in the new tank farm, as discussed in Section 2.4 below.

2.2 Rod Position Indication Failure - Unusual Event

During routine operation at 100% full power (FP) on January 13, the individual rod position indication (IRPI) for control rod #34 went to 315 steps at 3:15 a.m., which was below the rod insertion limit of 317 steps. Rod 34 is part of shutdown bank "D," which is positioned full out at 326 steps withdrawn and which had not been moved when the deviation occurred. At 3:30 a.m., shutdown bank "D" control rods 35 and 36 also went to 315 steps. Since the position indication for three rods in bank "D" deviated from the group position, the shift supervisor entered the Technical Specification 3.1.3.2.c Action Statement (TSAS), which requires that the reactor be taken to hot standby within 6 hours unless the IRPI is sooner made operable.

Instrument & Control (I&C) technicians reported to the plant to investigate the IRPI circuitry. Based on a preliminary evaluation by I&C that the cause for the IRPI deviation was not readily apparent, the shift supervisor directed the operators at 5:00 a.m. to begin a controlled shutdown in accordance with normal operating procedure NOP 2.2-1, "Changing Plant Load." The operators declared an Unusual Event - Delta 1 emergency classification at

5:00 a.m., based on the initiation of a shutdown required by the TSAS. The NRC Duty Officer was notified at 5:23 a.m. The state and local authorities were notified at 5:04 a.m. The NRC inspector was contacted at 5:15 a.m., and he responded to the plant.

The indication circuits for rods 34, 35 and 36 are part of shutdown bank "D" and are located in one drawer. I&C technicians identified a loose wire in the drawer, which was corrected under authorized work order (AWO) 94-1484. After the position indication was restored to normal, the plant load reduction was halted at 6:32 a.m. and TSAS 3.1.3.2.c was exited. The load decrease was halted at 72% FP. Plant operators began a controlled power increase in accordance with NOP 2.2-1. The operators sent a followup message to update the event status and confirm termination of the Unusual Event at 6:35 a.m.

The inspector reviewed the operator actions in response to the faulty position indication. The inspector confirmed that the operators responded properly to implement the TSAS, and the emergency plan. No inadequacies were identified in these areas, or in the actions to control plant load.

2.3 Unplanned Radioactive Gas Release - Unusual Event (IFI 93-22-01)

Following a power reduction to address inoperable rod position indications on January 13 (see section 2.2 above), a small release of radioactive noble gas occurred with the reactor at about 80% full power. The release occurred while operators were venting the volume control tank (VCT). Venting of the VCT was required to deborate the reactor coolant system as the reactor was being returned to full power. The release was unplanned but monitored, and resulted in a stack discharge of about 4.8 curies of radioactive gas over a ten minute period (8:05 a.m. to 8:15 a.m.). The stack release rate increased from the normal background level of 20 microcuries (μCi) per second, to about 8000 μCi/sec. Plant operators noted that the VCT vent valve (PU-SOV-250) was open and took actions immediately to close the valve.

Emergency Plan Implementing Procedure (EPIP) 1.5-1, "Emergency Assessment Using EAL Tables," lists criteria to identify when a release is reportable, including those that are determined to exceed the federal limits established in the technical specifications and in 10 CFR Part 20. None of the federal limits were exceeded. However, an unplanned release in excess of 1500 μCi/sec when averaged over 10 minutes exceeds procedural limits. Primary vent stack wide range radiation monitor R-14B records stack discharges. Using the control room chart recordings from radiation monitor R-14B, the shift supervisor recognized that the emergency action level for an unplanned release was met, and declared an Unusual Event (UE) at 8:30 a.m. on January 13. The notification to state and local authorities was made at 8:33 a.m. The NRC Duty officer was notified at 8:47 a.m. The resident inspector was in the control room following the licensee's response to the release and observed the actions to classify the UE and make the state and local notifications. Even though the release was

terminated at the time the event was classified, the shift supervisor appropriately deferred terminating the UE until after chemistry personnel identified the isotopes and further quantified the release.

Release Significance

Chemistry personnel responded to the control room to assist the operators in quantifying the release and to assess its significance. The release path was determined to be from the VCT through the waste gas vent header and directly to the stack without any filtration from the auxiliary building particulate or charcoal filters. The licensee used the flash gas mix of isotopes in the last reactor coolant system sample and actual meteorological conditions to calculate the offsite doses. The initial calculation showed that the release: (i) involved a total of 4.8 Ci of noble gas; (ii) contained no iodines; (iii) was less than 36% of the technical specification limit; (iv) the release was 19.9% of the 10 CFR Part 20 Maximum Permissible Concentration (MPC) for the isotopes involved when averaged over one hour; and, (v) the total dose at the site boundary from the release was 0.0077 milliRem. The shift supervisor declared the event terminated at 9:22 p.m., and provided this information in an update message to the NRC Duty Officer at 9:33 a.m.

An NRC inspector from the Region I Effluents Radiation Protection Section was at Northeast Utilities (NUs) corporate offices on January 13 and assisted the resident inspector in an assessment of the release. The NRC inspector used site data to perform an independent calculation of the release using PC DOSE. The NRC calculated the total dose at the site boundary to be 0.0033 milliRem, which was in excellent agreement with the licensee's ODCM results. The NRC assessment confirmed that the release was well below regulatory limits, and had an insignificant impact on public safety. The resident inspector shared this information with a representative of the State Department of Environmental Protection (who also responded to the plant) and briefed the state representative on NRC activities and assessments of the event.

Preliminary Investigation of Results

The licensee performed an immediate investigation of the event to determine how the release occurred and its causes. The inspector observed the licensee activities and independently confirmed the event sequence and causes. The release occurred as the VCT was being vented. The release path was from the VCT to the waste gas vent header to the waste gas surge tank to the waste gas relief line to the primary vent stack (see Figure 1). The licensee concluded that the relief valve on the waste gas vent header of the waste gas surge tank had lifted prematurely.

Venting of the VCT is a routine evolution that is done periodically during plant operation and without causing a release. VCT operation is covered in several plant normal operating procedures (NOP), including NOP 2.6-6, "VCT Operation," NOP 2.6-2, "CVCS Operation," and NOP 2.6-3, "Boration, Diluted and Blended Makeup." These procedures require the

operator to maintain VCT pressure in the range of 20 to 30 psig when filling the VCT by operating vent valve PU-SOV- 250 as necessary, and to vent the VCT prior to exceeding 75 psig. VCT pressure is maintained between 30 and 35 psig by the hydrogen regulator. These procedure requirements were met during the dilution activities on January 13.

On January 13, the control room operator opened valve PU-SOV-250 at about 8:05 a.m. during the dilution and intended to reclose the vent within two or three minutes. However, after opening PU-SOV-250, the operator was distracted from this task when he was contacted by the auxiliary operator (AO) working at the waste gas panel. While bringing the degassifier on line to process liquid to the borated waste storage tanks (BWST), the AO noted no flow through the degassifier, and a line blockage was suspected in the flow path from the primary drains tank (PDT). The degassifier should be run during deboration evolutions to assure that reactor coolant rejected from the charging system is stripped of fission gasses prior to storage in the BWST. The control room operator became involved with the AO to diagnose the degassifier problem and left the VCT vent valve open longer than intended, or about 5 to 10 minutes. When the AO noted the continuing input to the waste gas surge tank, the reactor operator noted the open vent path and closed PU-SOV-250. The blockage in the PDT process line was later determined to be a frozen section of pipe located outside the process buildings, between the PDT pump and the degassifier filter.

Although PU-SOV-250 was left open longer than intended during the venting operation, this action alone did not cause the unplanned gas release. The waste gas system is designed to operate assuming an open path from the VCT to the waste gas system. VCT valve PU-V-316 is throttled to limit the flow rate from the VCT into the waste gas vent header. The licensee's followup investigation confirmed that PU-V-316 was one turn open, as required. Waste gas compressors C-13-1A and 1B start automatically when the pressure in the waste gas header reaches 1.5 psi and 2.0 psi, respectively. Both compressors operated as expected during the event. The setpoints on the relief valves located both on the suction and discharge sides of the compressors are set to allow sufficient margin to the normal operating pressure in the header, as follows: VH-SV-1171 is set at 20 psig; WG-SOV-1156 is set at 14.5 psig; DG-RV-132 is set at 65 psig; and, WG-RV-1161A-D are set at 225 psig. However, the pressure in the waste gas header and the waste gas surge tank only reached about 4 psig during the release. The licensee concluded that one of the relief valves had misoperated and lifted prematurely. The initial investigation focused on valves WG-SOV-1156 and VH-SV-1171.

The licensee completed a test under tightly controlled conditions on January 13 to verify the VCT vent path. The VCT was vented under conditions identical to those that occurred at 8:00 a.m., except that an AO was stationed at the waste gas panel to continuously monitor pressure in the waste gas vent header, and the control room operator was directed to cease venting when pressure in the header reached 2 psig. The venting operation was completed successfully at 10:10 a.m. and without incident. The licensee instituted these measures as

interim administrative controls to govern all subsequent VCT venting operations until the investigation of the event was completed. A yellow caution tag was hung on the PU-SOV-250 control switch to remind operators of the interim measures.

Supplemental and Long Term Followup Actions

The following additional findings were developed during the licensee's subsequent review of the event.

- The stack charcoal cartridges were analyzed for iodine following the release. The results indicated that the iodine release was less than the lower limit of detectability at 3.0XE-12 μCi/cc.

- The solenoid operator for waste gas surge tank relief valve WG-SOV-1156 was tested and found to operate satisfactorily at the prescribed lift setpoint of 14.5 psig. Thus the mechanical relief valve (VH-SV-1171) on the waste gas surge tank was the likely malfunction causing the release. The licensee plans to test this valve, but deferred that action until system conditions allow isolation of the tank.

- Although the stack wide range radiation monitor R14B responded to the release, no alarms were received from the channel as expected when the readings rose above background. Additionally, the stack low range radiation monitor R14A is also in the flow path for the release. R14A should have, but did not show a response to the release. Both R14A and R14B were subsequently tested in the as found condition and were found to respond properly to a radioactive source. The licensee continued to investigate the performance of the radiation monitoring system, and to evaluate the potential impact of sample purging operations that were in progress concurrent with the release.

- The operators and maintenance personnel continued to investigate the status of the degassifier to identify the source of the blockage. The blockage was located in a section of piping just upstream of the degassifier prefilter, FL-67. Vent valve DG-V-200 was opened with the primary drains tank pump operating to maximize the differential pressure across the frozen pipe segment. Maintenance personnel also verified that the freeze protection circuit was energized, and increased the temperature setpoint from 80 degrees Fahrenheit (F) to 110 degrees F. The combination of these actions was successful to clear the line at about 2:10 p.m. on January 13. The licensee verified that the line was plugged with ice, and not precipitated boric acid. The line plugged because the line is used relatively infrequently and since outside air temperatures were well below freezing at the time due to an extended cold spell.

Licensee investigation of the event was ongoing at the end of the inspection period. Actions in progress included gathering data on the status and response of the waste gas system, interviewing operators and reviewing operator actions, evaluating the condition of relief

valves in the waste gas system; investigating the performance of the radiation monitors, and a review of the performance of the waste gas system. Site management directed that a formal root cause analysis be completed to assure that all contributing causes are identified and addressed. Additional engineering resources were assigned to assist in this effort.

Findings

The unplanned release of a small amount of radioactive gas did not adversely affect plant operation. Licensee analysis, confirmed by independent NRC calculations, showed that the release was well within regulatory limits and had an insignificant impact on public safety. The licensee considered any unplanned release as serious, and initiated prompt and comprehensive actions to understand the event thoroughly and to address its causes. Interim measures established to control venting operations were appropriate to prevent recurrence of the event pending the completion of the investigation.

Except for the delay in securing from the VCT venting operation, the operator actions during the event and to recover from the release were very good. Identification of the release by the auxiliary operator surveillance of tank pressures in the waste gas system (absent alarms from the radiation monitoring system) showed good attention to detail and good knowledge of the radwaste system and its interfaces with other system. The shift supervisor and the supervisory control room operator performed well to direct crew actions and to coordinate with plant personnel to implement the emergency plan and to recover from the release. The shift supervisor, in particular, performed well following the release to diagnose plant system status and to assure the VCT could be vented safely.

Licensee efforts to deal with the effects of extremely cold weather, and the NRC review of the cold weather protection program at Haddam Neck, are described further in Section 2.4 below. The inadequate freeze protection for the degassifier line created an operational distraction that contributed to the unplanned release.

In spite of the degassifier and operator performance problems noted above, the underlying cause of the unplanned release on January 13 is believed to be a malfunction of equipment in the waste gas system. Licensee actions to review the equipment and the performance of the waste gas system were appropriate.

The inspector reviewed the event and the licensee's response. The inspector independently confirmed the event sequence and the plant systems involved. No violations of NRC requirements were identified. Licensee actions to complete the investigation and to address the equipment performance issues be followed on a subsequent inspection **(IFI 50-213/93-22-01).**

2.4 Cold Weather Preparations (IFI 93-22-02)

The inspection objective was to determine whether the licensee has an effective program to protect safety-related systems against extreme cold weather. The inspection was to verify if a periodic station cold weather checklist exists, and if it adequately provides protection for instrumentation and piping. The inspection also was to determine if the licensee calibrated and tested instrumentation associated with heat tracing and thermostats in accordance with the established program. The inspection examined whether proposed modifications to correct or enhance freeze protection capabilities were appropriately evaluated and scheduled prior to the start of cold weather conditions. The inspector also reviewed the licensee's freeze protection annunciator response procedures to ensure that immediate and supplementary actions exist to preclude freezing in the event of a failure of the freeze protection system.

Heat Trace System Description

The heat tracing system at Haddam Neck serves the following functions; to maintain the temperature of components and piping which contain dissolved boric acid high enough to prevent the boron from coming out of solution, and to prevent freezing of components and piping which are exposed to the environment.

The heat tracing system consists of several independent sub-systems which provide heat to various piping systems and components which are located throughout the facility. The heating element of a particular heat trace circuit receives electrical power from a distribution panel which supplies several similar circuits. Ammeters are provided on the distribution panel to provide local indication of current flow through each of the heat trace circuits. The heating element is controlled by a thermostatic controller which closes contacts to energize the heating element when temperature is too low, and opens the contacts to de-energize the heating element when temperature is too high. The temperature of the heat trace zone (piping or component) being heated is sensed by a resistance temperature detector (RTD). Several types of heating elements are used in the heat tracing circuits. Pipes are provided with either wire wrap tape or fixed element heat trace conduit. Tanks are provided with immersion heaters or wrap around heating blankets.

The nine (9) sub-systems providing heat trace at the facility are; boron heat trace, waste disposal/primary auxiliary building heat trace, demineralized water storage tank (DWST) heat trace, primary water storage tank (PWST) heat trace, recycle primary water storage tank (RPWST) heat trace, refueling water storage tank (RWST) heat trace, boron waste storage tank (BWST) heat trace, auxiliary feedwater (AFW) heat trace, and freeze protection heat trace. The nine sub-systems are further divided into twenty-two distribution panels.

Freeze Protection Program

CYAPCo's freeze protection program includes operations department instruction (ODI)-146, "Cold Weather Operation Checklist," that inspects various safety-related equipment to ensure operability during cold weather (November 1 through April 1). The operations shift supervisor or supervising control operator is responsible to ensure that the ODI is performed weekly. The inspector reviewed the completed ODI-146 forms between December 12, 1993 through January 16, 1994. The results indicated that the equipment was checked on a weekly basis.

The primary nuclear system operator (NSO) also completes checks as identified in surveillance procedure SUR 5.1-0, "Steady State Operational Surveillance (Modes 1 through 4)." The primary NSO records boric acid heat trace temperatures, freeze protection panel heat trace and circuit currents, and RPWST and boric acid make-up tank (BAMT) temperatures. The secondary NSO checks DWST temperature, and the condition of the well water pump heat trace. The surveillance verifies three times a day that portions of the freeze protection system are operable. The inspector periodically verified tank temperatures and freeze protection circuits as documented in SUR 5.1-0 were acceptable. The inspector reviewed records to verify satisfactory completion of technical specification surveillances such as RWST temperature, boric acid system heat trace temperatures, and BAMT temperatures.

The inspector reviewed CYAPCo's response to IE Bulletin 79-24, "Freeze Protection." One commitment was to have operators ensure the operability of freeze protection for safety related lines by routine checks of the ammeter indication on the heat trace circuitry. The inspector noted that ODI-146 and the primary and secondary NSO log readings periodically verify heat trace circuitry using ammeters for all distribution panels except for the waste disposal/PAB heat trace, and the BWST heat trace, which are non-safety related. For the waste disposal/PAB and the BWST heat trace, alarms are located at the PAB annunciator panel. CYAPCo has annunciator response procedures ANN 4.2-64, "Heat Trace Trouble Waste Disposal Building," and ANN 4.2-20A, "BWST Heat Trace Trouble," to alert the NSO of problems with the heat trace sub-systems. The inspector noted the licensee satisfied the commitments made in the response to the bulletin, but questioned whether the good practice of using the ammeters should also be used for the circuits serving balance of plant systems. The licensee stated the program would be evaluated in light of the inspector's comments.

The inspector reviewed the annunciator response procedures for freeze protection to determine if sufficient immediate and supplementary actions exist to preclude freezing in the event of a failure of the freeze protection system. The inspector learned that no specific heat trace alarms exists in the control room; however, a common alarm exists for the primary auxiliary building annunciator panel, waste liquid annunciator panel, or waste gas annunciator panel alarm. The inspector reviewed the annunciator response procedures at the

waste liquid, waste gas, and primary auxiliary building annunciator panels. The procedures provided acceptable immediate and supplementary actions to preclude freezing as a failure of the freeze protection system.

The inspector reviewed past proposed modifications to address heat trace and freeze protection deficiencies. In March 1993, CYAPCo engineering developed a plant design change request (PDCR) to address sub-system deficiencies. PDCR 1331, "Miscellaneous Electric Heat Trace and Control Circuit Modifications," was a modification to allow engineering review and documentation for various minor electric heat trace and heat trace control circuit modifications. The PDCR was approved by the plant operations review committee (PORC) in March, 1993. The inspector noted, however, that no work requests were initiated and completed as a result of PDCR 1331.

The inspector noted that a temporary modification has been in place since November 1990, for heat tracing on the letdown post filter differential pressure indication piping. Bypass jumper 90-051 increased the heat tracing capacity to the piping above ground level for freeze protection and to prevent possible boric acid crystallization. The system engineer generated design change notice DCY-S-118-93 to PDCR 1331 in April 1993, to support the differential pressure box to allow for sufficient heat trace of the sensing lines. The licensee chose not to work the DCN during power operations due to the potential to breach the letdown line during relocation of the pressure box. The DCN was deferred from the last completed outage (July, 1993) due to a low priority in comparison to other outage modifications.

The inspector reviewed the results of the licensee's periodic maintenance program for heat trace panels. Two preventive maintenance procedures exist to functionally check the condition of the panels: PMP 9.5-146, "Freeze Protection Equipment Preventive Maintenance," and PMP 9.5-151, "HT-BA-PNL-A,B Boric Acid Heat Trace Panel Preventive Maintenance." The procedures were completed in November 1993, (PMP 9.5-146) and June 1993, (PMP 9.5-151). The inspector reviewed past maintenance practices on the heat trace panels based on the results of PMP 9.5-146. All distribution panels were functionally checked by the licensee between September 15 through November 4, 1993. Of the twenty-two distribution panels checked, ten tested unsatisfactorily. The electricians initiated twenty-four trouble reports (TRs) on the panels. Examples of the trouble report problems included: poor insulation, alarm thermostat needs replacement, heat trace probe not installed, thermostat rusted, and step down transformer needs replacement. At the time of the inspection, all trouble reports were developed into work orders, with only 6 out of the twenty-four items completed. All of the work orders were assigned a priority "4" which is defined by administrative control procedure (ACP) 1.2-5.1, "Work Control Process," as plant equipment repairs that can be done when time permits. The majority of the deficiencies involved the waste disposal/primary auxiliary building heat trace distribution panels. In conclusion, not all deficiencies identified by personnel performing the periodic maintenance were completed prior to the start of cold weather.

Based on discussions with the maintenance electricians, difficulty exists in the efficient completion of PMP 9.5-146. The electricians stated that no setpoint value or engineering evaluation exists for thermostat settings for heat trace distribution panels, except for HT-BA-PNL-A and B. Additionally, no specific acceptance criteria for "as-found" setpoints exist. A recent quality service (QAS) surveillance report, CY-QASD-94-002, also concluded that PMP 9.5-146 does not have acceptance criteria for the periodic checks of the distribution panels. CYAPCo assigned controlled routing (CR) 94-0058 to address this QAS surveillance issue. Additionally, the electricians stated that plant drawings were deficient, as they lack thermostat location and circuit heat trace location on a particular component. To accomplish the PMP, the electricians must "walk-down" the configuration to identify the circuit and thermostat locations.

Inspection of Heat Trace and System Conditions

During the inspection period, the inspector toured various heat trace distribution panels. The heat trace panels evaluated were: HT-FHD-PNL, "East and West Fire Headers," HT-WD-PNL-2A, 2B, and 2C, "Waste Disposal Building," HT-CWST-PNL-1, 2 "Condensate Storage Tank and Piping," HT-DWST-PNL, "DWST Tank," HT-BA-HT, "Boric Acid Heat Trace," HT-TANK-PNL, "RWST, BWST -A, -B," and HT-FP-PNL-A,B, "Primary Auxiliary Building Yard Freeze Protection."

On January 14, the inspector toured the new tank farm. The tank farm consists of radioactive waste systems including the aerated drain tank and piping, recycle test tanks and piping. Distribution panels HD-WD-PNL-2A and 2B provide heat trace circuits for the new tank farm. In the new tank farm, the inspector noted poor conditions on insulation around the recycle test tanks, several temporary heat tracing circuits (i.e. with extension cords), poor condition of some tank level transmitters, and circuit thermostats informally marked. The licensee recognized the need to address the condition of the new tank farm. The Unit Director assigned the engineering organization responsibility to develop a plan for resolution of the tank farm freeze protection/insulation upgrade by March 15, 1994.

The completed ODI-146 checklist identified deficiencies on the heat trace to the fire hydrants, which were blocked by snow and ice. The snow and ice were promptly removed to assure unrestricted access to the hydrant. ODI-146 also documented a long-standing deficiency on the "C" well water heat trace. Panel HT-FHD-PNL for the traveling screen water heat trace, which is supplied by 120-volt lighting panel LP-W1-1, had a TR since October, 1992. The deficiency was that the power supply to the heat trace breaker #27 on LP-W1-1 was undersized. The inspector confirmed that the breaker was in a "trip-free" condition. The deficiencies were unresolved at the end of the inspection period.

During the inspection period, five events were documented by the licensee in plant information reports (PIRs). The problems occurred during an extended period of extremely cold (near zero or sub-zero) temperatures. The problems were: condensate rupture disc - ruptured; a three inch radwaste line (LBRF-152A-3-3) froze; the "B" RWST level indicator

froze; the BWST level indicators froze; and, the letdown post filter differential pressure instrument froze. All of the events were identified directly by the instrument response, indirectly during a radwaste evolution, or during an NSO tour. Some of the radwaste line problems are recurrent due to a design deficiency where the process piping passes through a concrete (or other wall) penetration, which has no internal provision to maintain elevated temperatures. Although most problems involve non-safety related lines, in one case, a frozen instrument line resulted in the loss of redundancy in level indication for a safety related tank (RWST). The licensee identified the inoperable RWST channel, entered the action statement and made the instrument operable within the allowed TS outage time. The plugging of a portion of the degassifier liquid line diverted operator attention and contributed to an offsite release (see report detail 2.3). ODI-146 checks did not identify indicators affected by cold weather for each of the above events. Specific heat trace annunciators did not alarm for the areas as current was being supplied to the heating elements; however, the heat input was insufficient to preclude line freezing.

Summary

The inspector concluded that periodic cold weather checks and preventive maintenance of heat trace and freeze protection were completed by the licensee. Technical specification surveillances were performed satisfactorily. Overall, the inspector noted acceptable performance of the heat trace system for lines containing boric acid, and for technical specification equipment. The freeze protection program was implemented satisfactorily for safety related lines and instruments. However, the licensee has recognized the need to improve the heat trace system for certain non-safety related lines. Notwithstanding the completion of cold weather preparations, various frozen process lines and frozen instrument lines were identified by the licensee during the inspection period. Most problems were on non-safety related lines. One event involved an RWST level channel, which is important to safety. Short term corrective actions for the events restored the equipment to an operable status.

Design deficiencies exist with the freeze protection system on some balance of plant and radwaste lines, and deficiencies exist in the freeze protection program for those systems. The issues included a failure to correct all deficiencies prior to the start of cold weather, the lack of engineering justification for some thermostat setpoints, poor heat trace conditions in the new tank farm, and insufficient follow-up of past engineering modifications to correct known problems. A majority of the program deficiencies involve freeze protection controls for radioactive waste systems and balance of plant components. No violations were identified. CYAPCo action to address heat trace/freeze protection program issues is open **(IFI 50-213/93-22-02)**, and will be addressed in future NRC inspections.

2.5 Mispositioned Valves

This inspection evaluated CYAPCo actions in response to three events involving mispositioned pure water system valves. The events occurred between November 13 through

December 17. The inspection is a continuation of the inspector review of mispositioned valve events, as documented in inspection report 50-213/93-21 (section 2.3). Inspection item 93-21-01 was issued to track licensee actions to address the corrective actions associated with valve control.

The first event was identified by the licensee on November 13 at approximately 9:20 a.m. During a routine blended make-up to the volume control tank, the reactor operator noted insufficient primary water flow. Licensee investigation found that throttle valve PW-V-110 was locked closed instead of locked one turn open, and valve PW-V-111 was open instead of closed pursuant to normal operating procedure (NOP) 2.6-3, "Boration Dilution and Blended Makeup." The control room staff immediately realigned the mispositioned valves and performed a system line-up in accordance with NOP 2.6-3. PW-V-110 is a two and one half inch valve, and the required position is controlled in surveillance procedure (SUR) 5.1-126, "Locked Valve Checklist." The last recorded valve position check was July 12, 1993. The inspector discussed the valve check with the nuclear system operator (NSO) involved. The NSO could not recall the specific circumstances involved in July 1993. CYAPCo initiated a control routing (CR) 93-1751 for proposed corrective actions.

The second event involved chemical ion impurity introduction into the pure water storage tank (PWST) and the recycle primary water storage tank (RPWST). On November 11, during a weekly chemistry sample of the RPWST, the technicians identified elevated levels of chlorine, sodium and sulfates. The chemistry limit for the ions are less than 10 part per billion (ppb) for chlorides, and less than 5 ppb for sodium. The sample results on November 11 at 1:10 p.m. were 16.4 ppb chlorides and 7.5 ppb sodium.

Upon identification of the intrusion, chemistry sampling was increased from weekly to once every four hours. In addition to the increased chemistry sampling, CYAPCo initiated actions to identify the source of the intrusion and to drain and refill the RPWST tank. On November 13, at approximately 3:50 a.m. chemistry technicians noted elevated levels of chlorides, sodium, and sulfate ions in the PWST.

CYAPCo's investigation concluded that the source of ions was improper restoration of a temporary supply of seal water to the vacuum priming pumps. The normal supply of seal water is domestic water supplied from a hydropneumatic tank. During corrective maintenance on the hydropneumatic tank level control valve, an operator installed a temporary jumper hose from the pure water system to supply seal water to the vacuum priming pumps. Control room operators used annunciator procedure (ANN) 4.8-14B, "Vacuum Priming Tank Low Level," as guidance to install the temporary jumper hose, because guidance for the needed valve lineup was not in any other procedure, including the normal operating procedure (NOP) 2.20-1, "Vacuum Priming System Operation." The jumper was successfully installed, however, when the corrective maintenance on the hydropneumatic tank level control valve was completed, the jumper was left installed. The

installed jumper created a flow path when the domestic water was aligned to the pure water system that allowed the introduction of impurities (well water) into the RPWST and PWST tanks.

CYAPCo corrective actions included drain/refill PWST and RPWST removal of the temporary hose and procedural changes to ANN 4.8-14B and NOP 2.20-1. The inspector reviewed the drain and refill operations, and the procedure changes. The procedure changes provide specific valve alignments, and independent verification during jumper installation and removal.

The final event occurred on December 17, when no flow of recycle primary water occurred when required during a make-up to the volume control tank. CYAPCo investigation concluded that an the operator erred while reading a complex piping diagram and directed the NSO to perform an incorrect system valve lineup. Operators were using the piping drawings to align the RPW pumps to take suction from the PWST tank. The error resulted in valve RW-V-123 being closed, instead of open. CYAPCo corrective actions were to re-verify the alignment and initiate a CR to investigate the causal factors and corrective actions. The pure water system is not a safety-related system.

Although the above issues did not impact safety and were identified by the licensee, plant configuration control is of regulatory interest. The events are contemporaneous with and appear as a part of the valve control issues addressed in report 50-213/93-21 as a Notice of Violation. Therefore, the inspector will evaluate CYAPCo corrective actions in response to the Notice in report 50-213/93-21 as it relates to pure water system valve alignment errors.

3.0 MAINTENANCE (61726 and 62703)

3.1 Maintenance Observation

The inspectors observed various corrective and preventive maintenance activities for compliance with procedures, plant technical specifications, and applicable codes and standards. The inspectors also verified appropriate quality services division (QSD) involvement, proper use of safety tags, appropriate equipment alignment and use of jumpers, adequate radiological and fire prevention controls, appropriate personnel qualifications, and adequate post-maintenance testing. Portions of activities that were reviewed included:

3.1.1 Rod #36 Position Indication

The inspector reviewed licensee activities under AWO 93-15547 to troubleshoot the position indication circuit for control rod #36. The individual rod position indication (IRPI) for rod #36 drifted below the bank average position at 3:30 a.m. on December 27. There was no motion of the associated rod bank at the time. The IRPI drifted up and agreed with the bank average at 7:00 a.m. The IRPI drifted above the bank average at 9:00 a.m. Licensee investigation did not identify a cause for the problem. The IRPI was readjusted per CMP

8.2-70, "Rod Position Indication System Adjustment at Power," at 9:25 a.m. The operators correctly followed the requirements of Technical Specification 3.1.3.2 when the indication deviated from the bank average. Subsequent licensee action for this circuit is described in Section 3.1.2 below.

3.1.2 Bypass Jumper 93-006 For Rod #36 Position Indication

On December 30, the inspector witnessed the installation and removal of bypass jumper 93-006. The bypass jumper defeated the rod bottom bi-stables for control rods in shutdown bank "D." The installation of the jumper enabled the replacement of a 300 microfarad capacitor in the individual rod position indication system for control rod #36. The licensee entered technical specification action statement 3.1.3.2. to affect repairs. The allowed action statement was six hours, and the actual repair and restoration took approximately ten minutes. The inspector observed methodical actions taken by the instrument and controls specialists. The system engineer and reactor engineering personnel provided assistance when requested. No deficient conditions were identified during the corrective maintenance.

3.1.3 Shutdown Bank "D" Position Indication

The inspector reviewed licensee actions under AWO 94-1484 on January 13 to correct faulty position indication for three control rods in shutdown bank "D." The individual rod position indication for control rods 34, 35 and 36 had drifted below the rod insertion limit at 3:30 a.m., and caused the operators to reduce plant load in accordance with the technical specifications.

The IRPI circuits for all three rods are located in the same drawer. Instrument & Control technicians identified a loose wire that was common to all three rods. The wire provided the 120 volts in a parallel circuit to dropping resistors 1R, 5R and 9R, which in turn supply voltage to the primary coils of the linear voltage differential transformers for all three rods (reference Elementary Diagram K-7155-7, Sheet 4). The IRPI returned to a normal indication when the termination screw was tightened.

There has not been any recent maintenance on the subject wire in the rod circuits. The licensee concluded the screw loosened over time due to normal access to the drawer for work or testing. As followup action, the licensee completed a visual inspection of similar terminations for the other control rods, and used an infrared scanner to monitor the conditions within the drawers. No other anomalous terminations were noted.

This event was discussed in detail by the plant status meeting on January 13. For long term action, the licensee plans to consider what additional steps are warranted to assure the termination screws remain tight (e.g., use lock washers, check the screws during periodic maintenance on the drawers, etc.). The inspector had no further comments on this item.

3.1.4 PMP 9.2-177, Car Fan Cooling Testing

On January 11, the inspector observed instrument and control (I&C) specialists perform applicable sections of PMP 9.2-177, "Car Fan Cooling Coil Service Water Differential Pressure and Flow Instrumentation Calibration," for differential flow instrument PDI-1445-3. Instrument PDI 1445-3 measures the differential pressure across the No. 3 containment air recirculation (CAR) coolers. The decision to flush and calibrate the instrument was based on the apparent increase in the hydraulic resistance value for the No. 3 CAR cooler since July 1993. The licensee felt that it was appropriate to identify if fouling existed in the instrument or if silt or blockage existed resulting in inaccurate readings for hydraulic resistance.

The inspector observed good pre-job preparations by the I&C specialists. Pre-job preparations involved discussions and coordination with the system engineer, review of the applicable drawings and procedure, assembly of the appropriate test instrumentation and tools, and coordination with the operations department. As a result of the pre-job preparations, and planning of the activity, the time for the evolution was minimized.

The work activity under procedure PMP 9.2-177 resulted in brief loss of containment integrity (reference technical specification 3.6.1.1.) and inoperability of the containment air recirculation fan (reference technical specification 3.6.2). Containment integrity was breached since the service water piping inside containment is considered containment boundary since there are no tested containment isolation valves. The service water piping was opened during flushing of the differential transmitter, and during venting of the transmitter. CAR inoperability was based on closure of the service water discharge valve outside containment, thus isolating service water flow to the fan. CYAPCo entered TS action statement 3.6.1.1. for 18 and 11 minutes, during flushing and venting of the transmitter, respectively. The action statement allows one hour or a plant shutdown is required.

The inspector observed good procedural adherence by the I&C specialists. The transmitter flush water had indications of suspended solids. The calibration of the instrument resulted in minor adjustments to the "zero" setpoint. CYAPCo inservice test group performed the retest of the CAR fan hydraulic resistance pursuant to surveillance SUR 5.7-118, "Inservice Testing of CAR Fan Service Water Supply Header Check Valves and CAR Fan Cooling." The post-maintenance test resulted in a significant reduction of hydraulic resistance for the No. 3 CAR cooler.

The procedure requires that the vent caps on the differential pressure transmitter be removed. The inspector observed that the I&C specialists had to adjust a sensing equalizing line support to remove the vent cap. This issue was discussed with I&C supervision, who initiated a trouble report to address the interference of the support with removal of the vent cap.

Overall, the activity was performed well. The need to evaluate the function of the PDI-1445-3 was an appropriate management decision, taking into account the intended loss of containment integrity for brief periods of time. Future inspection will evaluate licensee actions in regard to the interference of the tube support to the transmitter vent caps.

3.2 Surveillance Observation

The inspectors witnessed selected surveillance tests to determine whether: frequency and action statement requirements were satisfied; necessary equipment tagging was performed: test instrumentation was in calibration and properly used; testing was performed by qualified personnel; and, test results satisfied acceptance criteria or were properly dispositioned. Portions of activities associated with the following procedures were reviewed:

3.2.1 Auxiliary Feed Pump (P-32-1A) Functional Test

On January 4, the inspector observed operators in the control room and in the terry turbine room perform technical specification surveillance SUR 5.1-13A "Auxiliary Feed Pump (P-32-1A) Functional Test." The inspector observed good procedural adherence and communications. The "A" auxiliary feed pump achieved all of the parameters in acceptance criteria of SUR 5.1-13A. The inspector observed good valve line-up verification techniques during the final system valve lineup.

3.2.2 CAR Fan Testing

The inspector reviewed test results from SUR 5.7-118, "Inservice Testing of CAR Fan Service Water Supply Header Check Valves and CAR Fan Cooling Coils," that was performed on January 11. The results indicated that all four CAR fan hydraulic resistance values were acceptable.

3.2.3 Auxiliary Steam Generator Feed Pump Test

On January 4, the inspector observed operators in the terry turbine room perform a partial inservice test surveillance SUR 5.7-87, "Inservice Testing of Auxiliary Steam Generator Feed Pump Control Valves (MS-PICV-1206A and 1206B)." The partial surveillance was only performed for valve MS-PICV-1206A. During the performance of step 6.2.8, the operator in the control room noted that valve MS-PICV-1206A automatically started to close as designed. The operator was unsure of the closing time of the valve, and recommended a restroking of the valve. The valve was restroked and all acceptance criteria were met.

SUR 5.7-87 has a note prior to step 6.2.6 to warn the control room operator to depress the start/stop pushbutton immediately after valve MS-PICV-1206A is locally observed travelling to the open position. The valve is designed to automatically close within 100 seconds after initial actuation (open valve). The need to perform the retest was due to untimely communications between the control room and the terry turbine building. This is the second

time this issue was noted by the inspector. The first time as documented in inspection report 50-213/92-08 section 4.2, and resulted in the licensee processing a temporary procedure change to add the note in the procedure. The inspector discussed this issue with licensee management. CYAPCo management was evaluating the procedural controls at the end of the inspection period. In conclusion, the inspector did not identify any procedural adherence problems or failure to meet the acceptance criteria.

3.2.4 Emergency Core Cooling Systems Test

On January 6, the inspector observed technical specification surveillance SUR 5.1-4, "Emergency Core Cooling Systems Test (Modes 1,2,3 and 4 (Tave > 315 F)." The surveillance objective was to demonstrate operability of the components of the Emergency Core Cooling Systems during power operation, and to verify that the primary system component leakage outside containment. The inspector independently verified procedural prerequisites, and observed the operator perform procedural sections 6.1 through 6.4. The surveillance met the acceptance criteria, and operators demonstrated good procedural adherence.

During the leak inspection of the "A" high pressure safety injection pump (procedural step 6.4.3.a.), the operators noted unacceptable leakage from the local discharge pressure indicator (PI-858A) fitting. The operator tightened up on the fitting, and during the maintenance activity the operator dropped a crescent wrench from the contaminated area to the non-contaminated area. The wrench was retrieved and properly placed into a container to be released. After the maintenance activity, the inspector requested the operator to have a health physics technician survey the non-contaminated area for a potential spread of contamination. The operator notified a health physics technician. Health physics swiped the area and identified no spread of radioactive contamination. The inspector noted the operator did not show attention to good health physics practices in this instance.

3.2.5 Spent Fuel Rack Boron Carbide (B_4C) Plate Inspection

The inspector reviewed the testing of the boron carbide (B_4C) coupons used in the spent fuel pool (SFP). Testing of the coupons containing boron carbide manufactured by Carborundum was completed during this inspection period in accordance with ENG 1.7-39. The inspector also reviewed the test results on the same coupons obtained per SUR 5.3-29 from 1978 to 1983. No degradation was observed in the coupons after the first 5 years of service. The measurements completed per ENG 1.7-39 on December 15, 1993 identified abnormal conditions and physical degradation. Since the 1993 data did not meet the procedure acceptance criteria, the licensee initiated PIR 93-251 to document the discrepancy, and began an operability evaluation of the spent fuel storage cells. The inspector reviewed this area in detail. The results are described in Section 4.2 of this report.

4.0 ENGINEERING AND TECHNICAL SUPPORT (71707)

The inspectors reviewed selected engineering activities. Particular attention was given to safety evaluations and plant operations review committee reviews.

4.1 Reporting Containment Air Recirculation Fan Failures (IFI 93-22-03)

During a Nuclear Review Board (NRB) meeting in November 1993, the board evaluated the unit's reportability determination for containment air recirculation (CAR) fan failures in May 1993. The reportability decision was documented in reportability evaluation form (REF) 93-25, "Three of Four Containment Air Recirculation Fan Flow Rate Failures." The Unit Director concluded on September 1, 1993 that the event was not reportable since firm evidence did not exist to change the time of discovery of inoperability (technical specification surveillance failure). The NRB requested a re-review of reportability of this event since the event involved multiple failures (three of four fans) and is indicative of a systematic problem. The NRB concluded that the CAR fans were inoperable during the past operating cycle.

Technical Specification surveillance procedure SUR 5.7-4, "In Place Testing of Containment Air Recirculation Fan HEPA and HECA Filters," in part, verifies that each fan can deliver 52,500 +/- 2500 cubic feet per minute (cfm) air flow during system operation pursuant to technical specification surveillance requirement 4.6.2.c.3. During the performance of SUR 5.7-4, three of the four CAR fans failed the flow test requirement. The measured flow rates were 48,480 cfm, 48,888 cfm, and 41,856 cfm. The CAR fan back draft damper assembly was reworked during the refueling outage, and the subsequent retest were satisfactory.

On January 4, CYAPCo personnel reevaluated the failed surveillance and documented this issue in plant information report (PIR) 94-02. On January 11, CYAPCo engineering recommended that the issue be reportable pursuant to 10 CFR 50.73 (a)(2)(i)(b) as a condition prohibited by technical specifications. NUSCo engineering provided supporting evidence that even with the lower than required air flows, the CAR fans could have fulfilled their safety function. The inspector reviewed the NUSCo engineering basis and CYAPCo engineering recommendations for this event. The inspector concluded that appropriate justification and basis existed that the CAR fans could have performed their intended functions in the "as-found" condition. The inspector concluded good inquisitive questioning by the NRB to the reportability of surveillance failures.

CYAPCo intends to submit a licensee event report (LER) in accordance with 10 CFR 5[illegible] to describe this issue, its safety significance and the bases for the conclusions summarized above. This item is open pending submittal of the LER and subsequent review by the NRC **(IFI 50-213/93-22-03)**.

4.2 Loss of Boron in Spent Fuel Rack Sample Coupons (IFI 93-22-04)

The inspector reviewed the testing of the boron carbide (B_4C) coupons used in the spent fuel pool (SFP). The spent fuel pool contains high density storage racks that were installed as a plant design change in 1977 and 1984. The rack design includes a nominal 10.75 inch pitch and B_4C neutron absorbing material, which is sufficient to ensure that the neutron multiplication factor (Keff) of the array remains below 0.95 with the pool filled with unborated water. The concentration of soluble boron in the SFP is maintained in excess of 2500 ppm. Boron carbide coupons are mounted in sample containers which are hung near the storage cells where recently discharged fuel is stored.

The purpose of the inspections, completed per engineering procedure ENG 1.7-39 (formerly SUR 5.3-29), is to verify that the boron carbide plates used in the fuel storage racks are maintaining structural integrity and minimum boron-10 (B^{10}) loading while exposed to the radiation and chemical environment in the pool. The boron carbide installed during the 1977 pool expansion (phase I) was provided by Carborundum. The supplier for the boron carbide was changed to ESK for the expansion completed in 1984 (phase II). The ESK samples have been inspected every year since 1984 and no degradation has been observed. The inspections of the Carborundum samples were done once a year from 1978 until 1983. No degradation was observed in the coupons after the first 5 years of service. The test frequency for Carborundum was changed to once per 10 years after the 1983 inspections.

The Carborundum samples consist of a "small" plate having an area of about 120 cm^2, and a "large" plate having an area of about 360 cm^2. Once the coupons are removed from the SFP and the holder, procedure ENG 1.7-39 requires plant personnel to: check the plates for physical degradation, such as crumbling or rounding of the edges; check the plates for chemical degradation, such as pitting or swelling; measure the plate thickness using a micrometer; dry and weigh the plates; and, calculate the areal density and the B10 loading. The present inspection findings are compared to those recorded during previous tests. The procedure acceptance criteria requires that there be no signs of decomposition or abnormal condition. The minimum loading is stipulated by the original rack specification SP-CE-73, and must be at least 0.0959 grams (gm) of B^{10}/cm^2. This acceptance criteria is also specified as an equivalent wet areal density of 0.972 gm/cm^2.

The measurements completed per ENG 1.7-39 on December 15 identified signs of abnormal condition and physical degradation. Black sediment was noted on the bottom left half of the sample plate, some of which adhered to the sample holder lid. The sediment was easily wiped off the lid. The top of the plate was slightly eroded, and the corners and edges were slightly rounded. The physical measurements also showed changes in weight and thickness when compared to the results in 1983. The nominal wall thickness of the sample varied originally between .211 to .228 inches. The thicknesses measured in 1993 reflected redistribution and loss of the sample material, with thicknesses ranging from 0.195 to 0.254 inches. The sample weights in 1983 were 370.4 grams (large plate) and 128.45 grams (small plate). The weights in 1993 were 344.7 grams for the large plate and 116.3 grams for the

small plate. In 1983, the wet areal density for the large plate was 1.02920 gm/cm^2, and 1.0713 for the small sample. In 1993, the areal densities were both unacceptable at 0.958 gms/cm^2 and 0.963 gm/cm^2, for the large and small plates, respectively.

Inspection procedure SUR 5.3-29 provided a calculational methodology for determining the B^{10} loading of the poison plate based on the measured mass of the sample, the original sample cross sectional area, and specified values of the boron content and B^{10} isotopic content. The areal density was also calculated using the measured mass of the sample and the original sample area. Due to absorption of water in the sample, the wet areal density has been determined to be 3.4% greater than the dry density. Using the above information, along with the vendor-supplied data for boron weight percent (55.6%) and B^{10} weight percent (18.35%) in the Carborundum plates, the dry boron loading is determined as follows:

Dry B^{10} Loading (gm/cm^2) = (Wet Mass)*(boron w%)*(B^{10} w%)/[(Sample Area)*(k)]

where, k =(Wet mass)/(Dry mass), and the Wet Areal Density = Wet mass/Sample Area.

Using the above formula, the dry B^{10} loading obtained from the December 15, 1993 inspection data was:

Small Sample

B^{10}(gm/cm^2) = (116.3) * (0.556) * (0.1835)/[(120.2) * (1.034)] = 0.0950

Large Sample

B^{10}(gm/cm^2) = (344.7) * (0.556) * (0.1835)/[(360.96) * (1.034)] = 0.0942

Both of these results show a B^{10} loading slightly less than the required value of 0.0959 g/cm^2 (or, approximately 2% less than the required value). The original design of the racks included sufficient margin to offset the reactivity penalty of a 2% reduction in the minimum B^{10} loading.

The impact of the reduced B^{10} loading on the criticality design basis was evaluated using both the original design analysis, and a recent criticality analysis performed in support of a proposed change to the technical specifications submitted on January 6, 1994. CYAPCo noted that a sensitivity study on B^{10} loading was provided in support of the SFP modifications in 1977 and 1984. The study shows that a reduction in the B^{10} loading from 0.0959 gm/cm^2 to 0.0459 gm/cm^2 would yield a Keff increase of 0.022. Therefore, assuming a conservative B^{10} loading reduction to 0.094 g/cm^2 would yield a Keff penalty of 0.00084. The limiting Keff for the current design basis is 0.94827. Application of the penalty yields Keff= 0.94827 + 0.00084 = 0.94911, which still meets the Keff $\leq$0.95 acceptance criterion.

CYAPCo is also planning to rerack the spent fuel pool by 1996 to allow an increase in the enrichment of fuel stored in the pool, and to provide a sufficient storage capacity for the remainder of the plant life. The limiting Keff for the proposed criticality design basis non-accident condition is 0.9457. Application of the penalty yields Keff = 0.9457 + 0.00084 = 0.9465, which still meets the Keff ≤ 0.95 acceptance criterion. The limiting Keff is for the accident case of dropping a fuel assembly between the pool wall and a rack. Since the resulting Keff increase is 0.041, this case conservatively requires that a soluble boron concentration of 500 ppm be maintained in the pool during fuel handling to yield a Keff ≤0.95. The boron penalty associated with the reduction in the rack B^{10} loading is only about 10 ppm. The proposed Limiting Condition for Operation requires 800 ppm. Thus, the limiting accident case also meets the Keff ≤0.95 acceptance criterion.

Findings

The inspector's review identified no inadequacies in the surveillance test method, the inspection techniques, or the calculations. The inspector observed the samples and confirmed the extent of the degradation documented by the licensee. The inspector independently calculated the sample areal densities and boron loadings, and verified the margins to the value required to maintain Keff ≤ 0.95. Based on the sensitivity study and considerable margins provided in the design of the racks, CYAPCo concluded that the spent fuel pool racks remained operable and that no reportable condition existed. The inspector identified no inadequacies in these conclusions.

CYAPCo review of the coupon inspection results were still in progress at the end of this inspection period. Several additional actions were in progress or under evaluation, including: reviewing the sample geometry to determine how closely it matches the actual rack geometry; sending the Carborundum and ESK samples to a laboratory to determine the actual B^{10} loading; preparing a Nuclear Network write-up describing the observed deterioration of the poison plate sample; revising the inspection interval to better track the sample deterioration; revising the B^{10} loadings in the criticality analyses to support the re-rack; considering a destructive examination of an existing rack following removal of the rack from the pool during the partial re-rack; and, reviewing Nuclear Network and other industry experience of B_4C poison racks. It was noted that Millstone 1 uses NUS racks with Carborundum supplied poison.

The inspector had no further comments on the licensee's actions or plans at this time. The completion of CYAPCo actions to address the degradation of the spent fuel pool poison material will be followed on subsequent inspections **(IFI 50-213/93-22-04)**.

5.0 PLANT SUPPORT (40500, 71707, 90712, and 92701)

5.1 Radiological Controls

During routine inspections of the accessible plant areas, the inspectors observed the implementation of selected portions of the licensee's radiological controls program. Utilization and compliance with radiation work permits (RWPs) were reviewed to ensure that detailed descriptions of radiological conditions were provided and that personnel adhered to RWP requirements. The inspectors observed controls of access to various radiologically controlled areas and the use of personnel monitors and frisking methods upon exit from those areas. The inspector verified posting and control of radiation areas, contaminated areas and hot spots, and labelling and control of containers holding radioactive materials were in accordance with licensee procedures. The inspector determined health physics technician control and monitoring of these activities were good.

5.2 Plant Operations Review Committee

The inspectors attended several Plant Operations Review Committee (PORC) meetings. The inspector verified technical specification 6.5 requirements for member attendance were met. The meeting agendas included procedural changes, proposed changes to the Technical Specifications, Plant Design Change Records, and minutes from previous meetings. PORC meetings were characterized by frank discussions and questioning of the proposed changes. Dissenting opinions were encouraged and resolved to the satisfaction of the committee prior to approval. The committee closely monitored and evaluated plant performance and conducted a thorough self-assessment of plant activities, including the unplanned release discussed in Section 2.3 above.

5.3 Review of Written Reports

Periodic and Licensee Event Reports (LERs) were reviewed for clarity, validity, accuracy of the root cause and safety significance description, and adequacy of corrective action. The inspectors determined whether further information was required. The inspectors also verified that the reporting requirements of 10 CFR 50.73 and Technical Specification 6.9 had been met. The following reports were reviewed:

- **LER 93-018-00, Feedwater Motor Operated Valves Declared Inoperable Due to Insufficient Closing Torque**

The licensee documented a condition that could have prevented the fulfillment of a safety function of a system needed to mitigate the consequences of an accident. Specifically, an engineering evaluation concluded that the feedwater isolation motor operated valves (MOVs) FW-MOV-11, 12, 13, and 14 may not operated under design basis conditions. The analysis was based on valve manufacturer's recommended values for valve factor, and that of the Electric Power Research Institute (EPRI) MOV valve factor data released in early December.

The difference in valve factors could result in the MOVs not performing their intended safety function. Previous NRC inspection of this issue was documented in report 50-213/93-21 section 4.1. Inspector review of LER 93-018-00 considers this issue closed.

- **Monthly Operating Report for November, 1993**

- **Special Report, Seismic Monitoring System Inoperability**

5.4 Follow-up of Previous Inspection Findings

Licensee actions taken in response to open items and findings from previous inspections were reviewed. The inspectors determined if corrective actions were appropriate and thorough and whether previous concerns were resolved. Items were closed where the inspector determined that corrective actions would prevent recurrence. Those items for which additional licensee action was warranted remain open. The following items were reviewed:

- (Closed) Unresolved Item 92-80-01, Inoperability of Diesel Fire Door D216

This item was unresolved pending further review of licensee root cause and corrective actions for inoperability of emergency diesel generator fire door D216. In August, 1992 the NRC identified that the fire door did not close on several occasions as personnel passed through when the diesel generator ventilation exhaust fans were in operation.

CYAPCo investigation concluded that the cause of the fire door not closing during access was a slight differential pressure during exhaust fan operation. Further, licensee investigation of emergency diesel generator room ventilation concluded that the measured air flows were below design values. NRC inspections documented in reports 50-213/92-12, 92-15, and 93-17 evaluated ventilation testing results and operability.

CYAPCo recently completed plant modifications PDCR 1339, "Emergency Diesel Generator Ventilation Modification," and PDCR 1387, "Emergency Diesel Generator South Door Foyer." The modifications and upgrade of the fire door closing mechanism under work order CY 93 14367 restored the fire doors to an operable status.

CYAPCo post-modification testing and calculations concluded that EDG ventilation flow can be less than the original design value. The reduction in design flow was based primarily on conservative vendor values for diesel heat generation rates and limitations to ambient temperatures. The ambient temperature limitations are 97 degrees F for the "A" emergency diesel generator and 95 degrees F for the "B" emergency diesel generator. The inspector evaluated licensee controls to periodically verify ambient temperatures as it relates to diesel operability. The control room logs require temperature readings every hour when ambient temperatures are greater than 85 degrees F from the meteorological tower. No violations were identified. This item is closed.

5.5 NRC Information Notice 92-16: Loss of Flow From Residual Heat Removal Pump During Refueling Cavity Draindown

The inspection initiative was to review the NRC Information Notice for applicability to the facility, and evaluate licensee response and or actions for the information provided. NRC Information Notice 92-16 and supplement 1 documented events at other facilities were a loss of residual heat removal pumps occurred due to erroneous cavity sightglass level indications. The erroneous levels were caused by inadequate vent paths from the pressurizer, improper valve alignments for the level indicators, and incorrect level compensation due to a slight nitrogen pressure on the pressure relief tank.

CYAPCo responded to the Information Notice using controlled routings F2881A and F297B. The Information Notices were issued on February 25, 1992 and May 5, 1992. The controlled routing was closed by station management on January 8, 1993. CYAPCo revised the following normal operating procedures (NOPs): NOP 2.9-3 "Refueling Cavity Filling;" NOP 2.9-5, "Reactor Cavity Dewatering;" NOP 2.4-1, "Filling and Venting the Reactor Coolant System"; and, preventive maintenance procedure (PMP) 9.2-181.1, "Reactor Coolant System Mid-Loop & Cavity Level Instrumentation In-service." The procedural revisions addressed proper verification of the cavity level tygon tubing arrangement, operations department control of valve alignments during PMP 9.2-181.1, and the addition of a new temporary control room alarm for cavity low level. The inspector verified the procedure revisions.

The licensee felt that no changes were necessary to ensure adequate venting of the pressurizer since the vent is directed to a hard piped header which is under a slight vacuum. The cavity level instrument is vented to containment atmosphere just as the reactor vessel is during cavity fill or dewatering. Pressurizer level is not used to monitor cavity level or vessel level changes during refueling; however, the licensee recognized that a level compensation is necessary to account for the slight vacuum pressure on the vent header.

The inspector concluded that CYAPCo's actions in response to the information provided in NRC Information Notice 92-16 were appropriate. The actions taken supported the refueling outage in mid-1993.

6.0 EXIT MEETINGS

During this inspection, periodic meetings were held with station management to discuss inspection observations and findings. At the close of the inspection period, an exit meeting was held to summarize the conclusions of the inspection. No written material was given to the licensee and no proprietary information related to this inspection was identified.

In addition to the exit meeting for the resident inspection held on January 28, 1994 the following meeting was held for an inspection conducted by a Region I based inspector.

Report No.	Inspection Dates	Reporting Inspector	Areas Inspected
50-213/94-01	1/10-14/94	J. Jang	Effluent Program

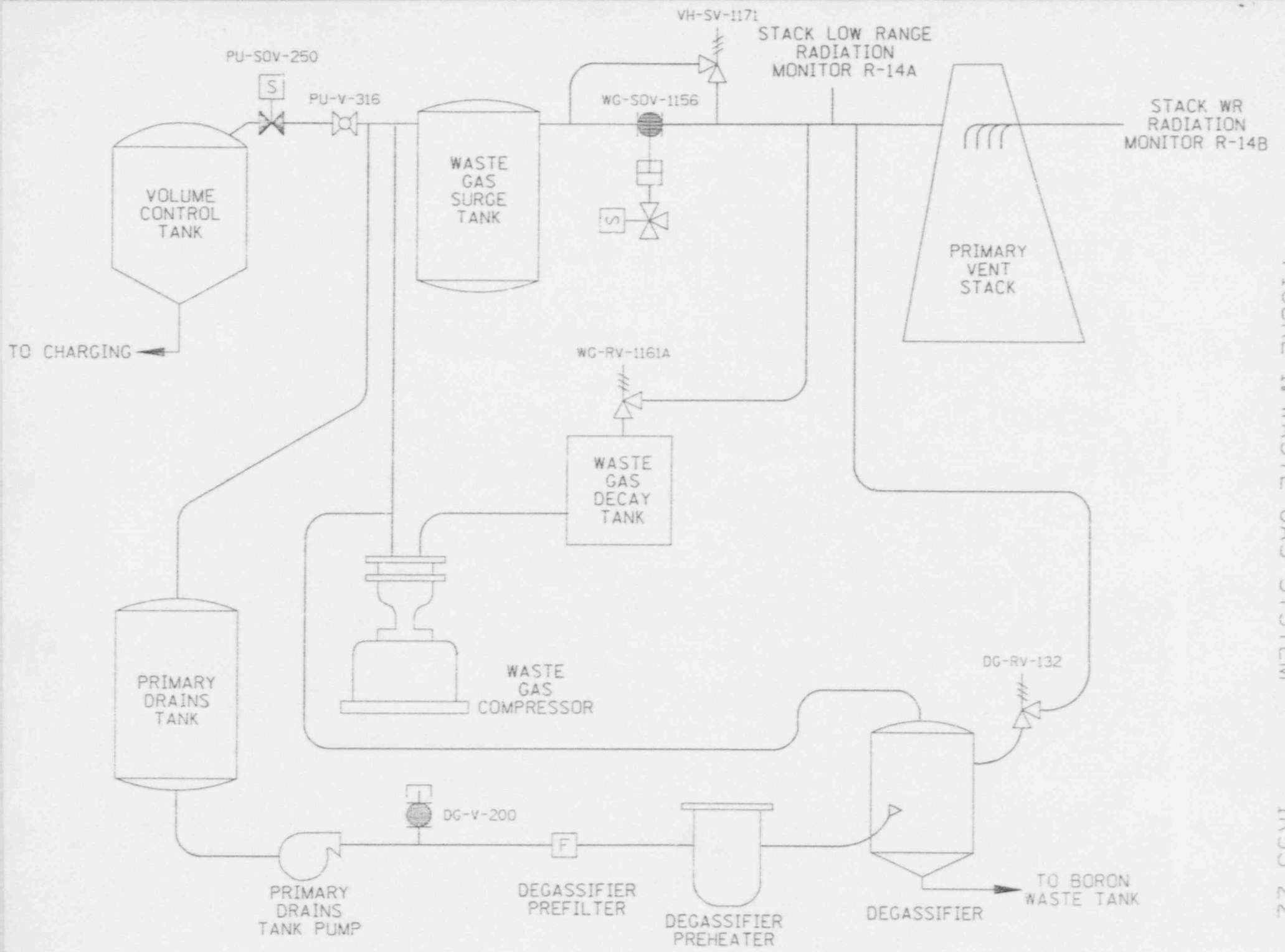

FIGURE 1. WASTE GAS SYSTEM

IR93-22