UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
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ATLANTA, GEORGIA 30323-0199

Report Nos.: 50-259/95-59, 50-260/95-59, and 50-296/95-59

Licensee: Tennessee Valley Authority
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1101 Market Street
Chattanooga, TN 37402-2801

Docket Nos.: 50-259, 50-260 and 50-296. License Nos.: DPR-33, DPR-52, and DPR-68

Facility Name: Browns Ferry 1, 2, and 3

Inspection Conducted: October 30 - November 3, 1995

Inspector: Thomas R Decker for 11/30/95
D. W. Jones, Radiation Specialist Date Signed

Approved by: Thomas R Decker 11/30/95
T. R. Decker, Acting Chief Date Signed
Plant Support Branch
Division of Reactor Safety

SUMMARY

Scope:

This special announced inspection was conducted in the areas of post accident sampling systems (PASS), accident monitoring instrumentation, water chemistry control, liquid radwaste processing, and control room emergency ventilation systems.

Results:

In the areas inspected, no violations or deviations were identified.

Installation of a new PASS for Unit 3 was complete. Procedures for operating the system were established and personnel had been trained in their use. The determination of whether the samples collected by the PASS are representative will be made after Unit 3 has been at full power operation for approximately 30 days. TMI Action Items II.B.3.3 (development of sampling procedures) and II.B.3.4 (installation of a permanent system) for Unit 3 are closed. Item II.B.3.2 (corrective actions to make the sampling systems operable) will remain open pending NRC review of the licensee's test results for representativeness of samples collected through the Unit 3 PASS (Paragraph 2). Installation of additional accident monitoring instrumentation for plant

Enclosure

effluents was complete. Procedures had been established for using the accident monitoring instruments and for interpretation of the data available from them. TMI Action Items II.F.1.1, II.F.1.2.a and II.F.1.2.b are closed for Unit 3 (Paragraph 3).

The licensee had effectively implemented changes to the water chemistry control program in support of resumption of Unit 3 operations. Two new sampling stations had been installed to monitor Unit 3 coolant water quality; one for sampling from the reactor water cleanup system and the reactor water recirculation system, and one for sampling condensate and feedwater (Paragraph 4).

The licensee had implemented an effective effluent release control program for compliance with state and federal regulations applicable to liquid radioactive effluents. The equipment and procedures used for sampling batches of liquid radwaste prior to their release were adequate for assuring that representative samples were obtained and the analytical procedures used to analyze those samples were appropriate for their application (Paragraph 5).

The Control Room Emergency Ventilation System adequately controls the relative humidity of the air entering the system's filter trains in order to maintain high charcoal adsorption efficiency (Paragraph 6).

REPORT DETAILS

1. Persons Contacted

Licensee Employees

†*T. Abney, Unit 3 Recovery Manager, Nuclear Assurance and Licensing
†*J. Corey, Manager, Radiological Control and Chemistry
†*C. Davis, Corporate Licensing
*T. Dexter, Manager, Training
J. Fenton, Chemist, Chemistry
†*J. Grafton, Technical Support Supervisor, Chemistry
†*J. Johnson, Manager, Site Quality
†J. Maddox, Manager, Maintenance and Modifications
†*J. McCarthy, Lead Engineer, Mechanical/Nuclear Engineering
J. McCormack, System Engineer, Systems Engineering
D. McDaniel, Chemist, Chemistry
K. Nesmith, Chemist, Chemistry
D. Nix, Chemist, Chemistry
†*G. Pierce, Manager, Technical Support
*E. Preston, Plant Manager
†*J. Sabados, Manager, Chemistry
*P. Salas, Manager, Licensing
†J. Shaw, Supervisor, Technical Support
*T. Shriver, Manager, Nuclear Assurance and Licensing
†*J. Wallace, Compliance Engineer, Site Licensing
†*S. Wetzel, Acting Manager, Compliance
*J. White, Manager, Outages
†*H. Williams, Manager, Engineering and Materials

Other licensee employees contacted included engineers, technicians, and administrative personnel.

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M. Morgan, Resident Inspector
J. Munday, Resident Inspector
†*R. Musser, Resident Inspector
L. Wert, Senior Resident Inspector

†Attended entrance interview
*Attended exit interview

2. Post Accident Sampling Systems (TI 2515/065)

Technical Specification (TS) 6.8.5 for Unit 3 requires that postaccident sampling activities will ensure the capability to obtain and analyze reactor coolant, radioactive iodines and particulates in plant gaseous effluents, and containment atmosphere samples under accident conditions. Those activities were required to include procedures for sampling and analysis, training of personnel, and provisions for maintenance of sampling and analysis.

During two previous inspections (reference NRC Inspection Report Nos. 50-259, 50-260, and 50-269/95-40 and 95-47) the operational readiness of the new Unit 3 Post Accident Sampling System (PASS) was reviewed. The scope of those reviews included system design, equipment installation, sampling and analytical capabilities, equipment operational procedures, analytical procedures, personnel training, and system maintenance. Based on those reviews, the TMI Action Items II.B.3.2, II.B.3.3, and II.B.3.4 remained open pending NRC review of the functional testing and calibration of the Unit 3 PASS. During this inspection, the records and results for Post Modification Test (PMT) No. 193, "Unit 3 PASS Testing;" were reviewed. The inspector noted that the Test Description section of the "Post Modification Test Instruction" for PMT-193 indicated that the purpose of the test was to ensure that the PASS could perform as designed. The test included checking logic, interlocks, valve function, valve leakage, flows, flow paths, instrument functions, primary containment isolation bypass logic, and timed sample collections. The test description also indicated that the determination of whether the samples collected by the PASS are representative will be made after Unit 3 has been at full power operation for approximately 30 days. The test instruction included acceptance criteria which the inspector found to be consistent with those specified in the "Test Scoping Document" for PMT-193. The licensee indicated that the Test Scoping Document was issued as part of the Design Change Notice (DCN) for instillation of the new PASS. The PMT records indicated that seven test deficiencies were identified during performance of the PMT and that all seven had been resolved. The PMT records also included a memorandum which indicated that the testing was complete and that the test results were granted full approval by Site Engineering.

The inspector and the licensee's cognizant Chemist toured the area in the Unit 3 Turbine Building where the PASS control panel and sampling equipment were located. Installation of the system was observed to be complete and there were no out-of-service tags posted on the equipment. The inspector also noted that tools and supplies, sample containers, sample handling apparatus, and shielded containers for transporting samples to the laboratory were stored adjacent to the control panel and were readily available for use.

Based on the reviews and observations made during this inspection and the two previous inspections referenced above, TMI Action Items II.B.3.3 (development of sampling procedures) and II.B.3.4 (installation of a permanent system) for Unit 3 are closed. Item II.B.3.2 (corrective actions to make the sampling systems operable) will remain open pending NRC review of the licensee's test results for representativeness of samples collected through the Unit 3 PASS.

No violations or deviations were identified.

3. Accident Monitoring Instrumentation (TI 2515/065)

Item II.F.1 of NUREG-0737 "Clarification of TMI Action Plan Requirements", in part, required the licensee to install additional accident monitoring instrumentation. Enclosure 3 to NUREG-0737 provided

clarification of NRC technical positions for noble gas effluent monitoring and for sampling and analysis of plant effluents. NUREG-1435 delineated, in part, the following specific requirements for accident monitoring capability:

Item II.F.1.1 Develop procedures for the use of accident monitoring instruments and the interpretations of the data available from them;

Item II.F.1.2 Install the following accident monitoring instruments which read out in the control room:

(a) In-line noble gas monitors capable of sensing the range of 10^2 Ci/cc to 10^5 Ci/cc;

(b) Continuous iodine/particulate sampling capability and corresponding laboratory analysis capability.

The licensee's implementation of the above TMI Action Items for accident monitoring capabilities was reviewed during two previous inspections (reference NRC Inspection Report Nos. 50-259, 50-260, and 50-269/95-40 and 95/47). The scope of those reviews included: system design and capabilities; equipment installation; procedures for system operation, equipment calibration, and interpretation of system data; and calculations of radiation exposure to equipment and personnel. Based on those reviews the licensee's activities pertaining to installation of additional accident monitoring instrumentation were determined to be adequate and complete except for calculations of the estimated radiation dose to personnel while collecting and analyzing samples. Therefore, the TMI Action Items II.F.1.1, II.F.1.2.a and II.F.1.2.b remained open for Unit 3 pending NRC review of those calculations.

As described in section 7.12.3.3 of the Final Safety Analysis Report (FSAR), the licensee had installed a Wide Range Gaseous Effluent Radiation Monitoring System (WRGERMS) at the main stack to provide the capability to detect and measure concentrations of noble gas, radioiodine and particulates in gaseous effluents during and following an accident. The design basis for the gaseous effluent accident monitoring instrumentation was required to be such that plant personnel could remove samples, replace sampling media, transport the samples to the onsite laboratory, and analyze the samples without exceeding the occupational radiation exposure criteria of General Design Criteria 19. During the previous inspection, the inspector noted that the exposure to personnel during laboratory analysis of the samples had not been included in the calculations of the estimated mission dose for the above activities. The licensee indicated that a contract had been let for recalculation of the mission dose to include exposure during sample analysis and that the calculations would be completed by the end of September 1995. During this inspection the licensee's records for recalculation of the dose to personnel when handling samples from the WRGERMS following an accident were reviewed. The inspector determined that appropriate methodology and assumptions were used in the dose

calculations. The results of those calculations indicated that the exposures to a single individual performing all of the actions required to collect and analyze the samples would exceed the dose limit for whole body exposure to an individual and therefore performance of the sampling and analysis activities would have to be divided among two or more individuals. The inspector also visited the room in the base of the main stack where the WRGERMS was located and verified that the distances between the potential radiation sources and the sampling personnel were consistent with the estimated distances used in the dose calculations. The procedural steps for collecting samples were also verified to be consistent with the sequence of actions assumed for the dose calculations. The inspector also noted that extension tools for handling samples and shielded containers for transporting samples to the laboratory were stored across the room from the WRGERMS equipment and were readily available for use.

Based on the reviews and observations made during this inspection and the two previous inspections referenced above, TMI Action Items II.F.1.1, II.F.1.2.a and II.F.1.2.b are closed for Unit 3.

No violations or deviations were identified.

4. Water Chemistry Control (84750)

Technical Specifications (TS) 3/4.6.B for Unit 3 described the operational and surveillance requirements for chloride concentration, conductivity, pH, and specific activity in the reactor coolant. Operational limits for those attributes and sampling frequencies were specified for various operational conditions. Action statements applicable to specific operational modes were also provided for conditions in which the operational limits were exceeded.

During the inspection conducted on August 21-15, 1995, (reference NRC Inspection Report Nos. 50-259, 50-260, and 50-269/95-47) changes to the water chemistry control program in support of resumption of Unit 3 operations were reviewed. At the time of that inspection, two new sampling stations had been installed to monitor Unit 3 coolant water quality; one for sampling from the reactor water cleanup system and the reactor water recirculation system, and one for sampling condensate and feedwater. The new sampling stations provided the licensee with in-line monitoring capability for analysis of conductivity, dissolved oxygen, anions and cations. Functional testing and calibration for the new sampling equipment was scheduled for completion by mid-September 1995.

During this inspection, the inspector toured the plant areas where the new sampling stations were located and discussed their operational status with the licensee's cognizant chemist. At the time of the tour, the conductivity monitors were observed to be operable. The dissolved oxygen monitors had been tested and calibrated, but, as a matter of good measurement practice, the in-line oxygen sensors will be cleaned and recalibrated prior to unit startup. The ion chromatographs (ICs) at the reactor water sampling station were ready for use but, again for good

practice, routine instrument calibrations will be performed prior to use. Routine maintenance was being performed on the ICs at the condensate and feedwater sampling station. The licensee indicated that routine preventive maintenance is required to be performed frequently on ICs in order to keep them operating at their optimum level of performance. The inspector determined that the licensee was adequately progressing toward having the new sampling stations available for restart of Unit 3.

The inspector also reviewed 16 new or revised procedures related to the use of the new sampling stations. Those procedures provided instructions for the following areas: sampling plans, operation and maintenance of sampling equipment, instrument troubleshooting and preventive maintenance, and routine instrument calibrations. The inspector verified that the procedures were available and approved for use.

Based on the above reviews and observations, it was concluded that the licensee had effectively implemented changes to the water chemistry control program in support of resumption of Unit 3 operations.

No violations or deviations were identified.

5. Liquid Radwaste Processing System (84750)

Section 9.2 of the FSAR described the system for collection, treatment, and disposal of liquid radioactive waste. The system consists of piping and equipment drains for collecting liquid radioactive waste from various areas and equipment in the plant, collection tanks for high purity, low purity, chemical, and detergent wastes, filter demineralizers for cleaning the liquid waste, and storage tanks for the processed water. If the processed water is of adequate quality it is transferred to the condensate storage tank for reuse as makeup water, otherwise it is discharged from the plant. Prior to discharge, compliance with release limits is confirmed. The system was designed with sufficient capacity to accommodate operation of all three units of the plant.

During this inspection the licensee's actions taken in response to Problem Evaluation Report (PER) No. BFPER951561 were reviewed. That PER was initiated to document a concern that the licensee's procedures for releasing liquid effluents were not adequate for detecting radioactive resins in water discharged from the plant. Given the implication that the facility was not in compliance with state and federal regulations for liquid effluent releases, the license initiated an Incident Investigation (II) to evaluate the concern. A copy of the II Report was provided to the inspector for review. As indicated in that report, the II team performed a thorough review of the following areas related to the concern: the issues raised in the "Description of Condition" section of the PER, the liquid radwaste system design, the previous operating experience related to resin intrusions into the liquid radwaste processing system, the applicable regulations for liquid effluent releases, the procedures used for permitting releases, the procedures

and their bases for obtaining representative samples for batch releases, the annual radiological effluent release reports, and the annual radiological environmental monitoring reports. The II team determined that the process for obtaining samples from the radwaste batch release tanks ensured that the samples were representative, that the liquid effluent releases were in compliance with applicable state and federal regulations, and that the releases have a negligible impact on the radiation dose to the public. The inspector determined from the review of the II Report that the licensee had aggressively pursued the issues raised in the PER in order to resolve the concern and to assure that liquid effluent releases from the plant had not adversely affected the health and safety of the general public.

The inspector also toured the Radwaste Building in which the liquid radwaste processing system was located. The licensee's cognizant chemist identified for the inspector the Floor Drain Sample Tanks (FDST) and the Waste Sample Tanks (WST) which were used for collecting batches of liquid radwaste. The licensee indicated that the FDST was used for collecting the liquid radwaste that is normally discharged from the plant and the WST was used for collecting higher quality water that is normally reused in the plant. The licensee also identified the pumps and recirculation piping used for homogenizing the batches of liquid radwaste and the points in the recirculation lines at which batch samples were collected. The inspector noted that the arrangement of the recirculation piping was consistent with the system design as the licensee had described in the II Report. The recirculation system takes suction from the bottom of the tanks and returns through four educators in each tank. The educators were used to enhance mixing in the tanks and ensure samples are representative. The inspector also noted that procedure 0-SI-4.8.A.1-1 "Liquid Effluent Permit" specified that the minimum recirculation time before sampling from the FDST was 25 minutes. The results of Special Test 88-1 "Radwaste Disposal System Representative Sample Determination -Floor Drain Sample Tank - 1 Pump", performed during February 1989, were reviewed by the inspector. The data gathered during that test indicated that adequate mixing could be achieved with 15 minutes of recirculation but for conservatism the minimum recirculation time before batch samples were to be collected was administratively established at 25 minutes. Procedure 0-SI-4.8.A.1-1 also specified the acceptance criteria which must be met, based on the analytical results from the batch samples, before a batch could be released. The inspector determined that those criteria were consistent with the requirements of the Offsite Dose Calculation Manual (ODCM), 10 CFR 20, Appendix B, and National Pollutant Discharge Elimination System (NPDES) Permit No. AL0002080. Pursuant to the licensee's sampling procedures, each batch was required to be analyzed for radionuclide concentration and turbidity. In addition, composite samples were required to be analyzed twice per week for total suspended solids (TSS). The analysis for radionuclide concentrations was performed to demonstrate compliance with the limits in 10 CFR 20 for concentrations of radioactive materials in effluents released to unrestricted areas. The batch samples were analyzed for turbidity, which is correlated to TSS, to assure that the limit for TSS in the composite samples would not be exceeded. The composite samples were analyzed for TSS to demonstrate

compliance with the NPDES Permit. In order to determine whether the licensee's analytical procedures for turbidity and TTS were appropriate for this application, the inspector compared procedures CI-683 "Turbidity" and CI-622 "Total Non-Filterable Residue" to the referenced methods in "Standard Methods for the Examination of Water and Wastewater". From that comparison, the inspector determined that the licensee's procedures were appropriate for their application and consistent with the analytical methodology in the standard methods. In order to evaluate the overall effectiveness of the licensee's effluent release control program, the inspector reviewed the licensee's Annual Radiological Environmental Operating Report for calendar year 1994. The report indicated that the majority of the activity detected in the environmental samples was a result of naturally occurring radioactive materials or the result of fallout from nuclear weapons testing. Small amounts of Co-60 and Cs-137 were detected in sediment samples collected downstream from the plant but that amount of activity would not result in a measurable increase over background in the dose to the general public. Plots of the Co-60 and Cs-137 concentrations detected in sediment samples collected since 1969 indicated that their concentrations were lower than the preoperational average concentration and exhibited a decreasing trend.

Based on the above reviews and observations, it was concluded that the licensee had implemented an effective effluent release control program for compliance with state and federal regulations applicable to liquid radioactive effluents. The equipment and procedures used for sampling batches of liquid radwaste prior to their release were adequate for assuring that representative samples were obtained and that the analytical procedures used to analyze those samples were appropriate for their application.

No violations or deviations were identified.

6. Control Room Emergency Ventilation System (84750)

Technical Specifications (TSs) 3/4.7.E for Units 2 and 3 described the operational and surveillance requirements for the Control Room Emergency Ventilation Systems (CREVS). The systems were required to be operable at all times when any reactor vessel contained irradiated fuel. Action statements were provided for conditions in which either of the systems were inoperable. The frequencies for functional testing, filter leak testing, air flow measurements, differential pressure measurements, and charcoal adsorption efficiency testing were specified. As described in section 10.12.5.3 of the FSAR, the CREVS is activated by an accident signal or high radiation signal from the Control Building intake duct radiation monitors. Upon receipt of an accident signal, the normal control room makeup air supply is isolated and outside air is drawn from two intake ducts through a common high efficiency particulate air (HEPA) filter bank located in the Unit 2 ventilation tower. The filtered air is supplied to either of two independent filter trains consisting of heating elements, charcoal adsorber filter beds, post filters, and fans.

In order to maintain high charcoal adsorption efficiency, each train has an electric duct air heater, located upstream of the charcoal adsorber filters, for the purpose of maintaining the relative humidity of the incoming air to less than 70 percent.

The inspector discussed operation of the CREVS with the licensee's cognizant system engineer. The focus of the discussion was the means by which the relative humidity of the incoming air to the filter trains is maintained below 70 percent. The licensee indicated that the CREVS design did not include the use of humidistats but, rather, the system was designed such that the electric duct air heaters would operate continuously when the system is activated. As depicted on drawing O-47E931-12 "Mechanical, Heating, Ventilating & Air Conditioning Controls", the temperature of the air as it exits the heaters and the charcoal filters is monitored to assure that the heaters are operating and a relative humidity indicator monitors the moisture content of the air as it enters the filter trains. The inspector also reviewed procedure O-SI-4.7.E.6 "Control Room Emergency Ventilation System 10 Hour Operability Test" and determined that it included provisions for recording the above temperatures and relative humidity at the beginning and the end of the monthly 10 hour operability test. The records for one such test performed on October 29, 1995, indicated that the relative humidity of the air entering the filter trains was typically less than 50 percent during the test.

Based on the above reviews and discussions, it was concluded that the CREVS adequately controled the relative humidity of the air entering the system's filter trains.

No violations or deviations were identified.

7. Exit Interview

The inspection scope and results were summarized on November 3, 1995, with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results listed above. No dissenting comments were received from the licensee. Proprietary information is not contained in this report.