UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

SEP 25 1986

Report No.: 50-302/86-28

Licensee: Florida Power Corporation
3201 34th Street, South
St. Petersburg, FL 33733

Docket No.: 50-302 License No.: DPR-72

Facility Name: Crystal River 3

Inspection Conducted: August 19-25, 1986

Inspectors: P. G. Stoddart 9/17/86
P. G. Stoddart Date Signed

J. D. Harris 9-17-86
J. D. Harris Date Signed

Approved by: W. J. Ross for 9-17-86
W. E. Cline, Section Chief Date Signed
Division of Radiation Safety and Safeguards

SUMMARY

Scope: This special inspection involved investigation of the lost ion exchange resin event of May 1986.

Results: Of the areas inspected, no violations or deviations were identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*M. Mann, Nuclear Compliance Specialist
*W. Rossfeld, Nuclear Compliance Manager
*P. Skramstad, Nuclear Chemistry/Radiation Protection Superintendent
*P. Breedlove, Nuclear Records Management Supervisor
*N. Hernandez, Senior Nuclear Quality Assurance Specialist
*R. Wilson, Site Nuclear Licensing Manager
*R. Wittman, Nuclear Operations Superintendent
*P. Alberdi, Site Nuclear Support Manager
*J. Smith, Nuclear Compliance Specialist
*R. Clarke, Radiation Protection Manager
*A. Kazemfari, Alarm Specailist
*V. Roppel, Technical Support Manager
*E. Welch, Nuclear Plant Engineer
*C. Brown, Outage Manager
*G. Becker, Manager Site Nuclear Engineering Services
*E. Ford, Operating Experience Specialist
*G. Clymer, Nuclear Waste Supervisor
B. Roberts, Chief Operator Nuclear Waste
D. McCollough, Nuclear Chemistry Supervisor

Other licensee employees contacted included construction craftsmen, engineers, technicians, operators, mechanics, security force members, and office personnel.

NRC Resident Inspectors

T. Stetka
J. Tedrow

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on August 21, 1986, with those persons indicated in Paragraph 1 above. The inspectors identified one unresolved item regarding the loss of ion exchange resin at this time. The licensee expressed no dissenting opinions or comments. In a telephone conversation between licensee representatives and the inspectors on August 25, 1986, the licensee provided additional information relevant to the inspection.

3. Licensee Action on Previous Enforcement Matters

(Closed) Violation 86-11-01: The inspector reviewed the licensee's commitment to revise procedure OP-417, Containment Operating Procedure (6-18-86) and new procedure WP-402, Operation of the Tritan Hydrolaser Pump (8-8-86). The licensee has fulfilled commitments made in response to the violation.

(Closed) UNR 84-26-02 - Revise ODCM, clarify manual calculation, modify computer software. The inspector reviewed a recent software verification report that was performed by an outside vendor. Their results confirm that the computer software used for monitor alarm setpoints and offsite doses and the mathematical methods detailed in the Offsite Dose Calculation Manual are equivalent.

4. Radioactive Liquid Radwaste Systems (84723)

On May 20, 1986, licensee personnel informed the resident NRC inspector of the probable loss of approximately 20 ft^3 of mixed bed demineralizer resin from the No. 6 demineralizer vessel of the miscellaneous radioactive liquid waste demineralizer system at Crystal River Unit 3. The loss was discovered on May 20, 1986; however, subsequent investigation failed to determine the date or period of the loss, which apparently occurred at some time between the re-loading of the vessel in August 1985, and May 16, 1986, the date at which the last run was made prior to changing resins on May 20, 1986.

The licensee considers that the resins were flushed out into the evaporator condensate storage tank (ECST) and subsequently discharged to the environment via the seawater discharge facility. While this is a logical explanation, resin beads were not seen in samples of tank contents. The tank contents were circulated prior to, during, and following sampling until the tank was discharged; since the resin beads were only slightly more dense than water, recirculation should have caused the beads to be suspended and should have resulted in a substantial number of beads being seen in the samples of about five liters. No such report was made in the approximately three years of operation of the system.

The licensee has calculated that if the resins were present through the last cycle and had removed activity from batches of processed water as indicated by analysis of influent-effluent samples, then the maximum calculated activity accumulated on the resins would have been 38 millicuries.

The miscellaneous radioactive liquid waste demineralizer system consists of six stainless steel vessels, each having a nominal internal volume of 25 ft^3 and a treatment media capacity of approximately 20 ft^3. Lineup and normal loading of the system vessels, which are arranged in hard-piped series configuration, was stated to be as follows:

a. Prefilter and charcoal bed

b. Charcoal bed

c. Cation bead ion exchange resin bed

d. Cation bead ion exchange resin bed

e. Anion bead ion exchange resin bed

f. Mixed anion-cation bead ion exchange resin bed

Each vessel was constructed in such a manner that flow was downward, with liquid flowing into the bottom compartment of the vessel through a stainless steel plate on which were installed six "Johnson" filters (a "Johnson" filter is a wire-wound right cylinder in which precise spacing between wires allows liquid to flow through the spaces between wires but which retains the resin beads).

Flow from the last vessel in the series arrangement was directly to the evaporator condensate storage tank (ECST), which was utilized as a holdup or monitor tank, where processed liquid was retained pending sampling and analysis prior to disposal. Disposal was typically by pumping to the seawater discharge from the turbine condenser cooling system. In the licensee's evaluation, it was assumed that the missing resin was discharged via the seawater discharge system.

Since the No. 6 demineralizer vessel was last recharged in August 1985, 64 batches of liquid waste were processed through the demineralizer system, totalling approximately 750,000 gallons. Shortly before the last batch of water was processed, inadvertent leaks of phosphoric acid solution from decontamination operations, and of sodium hydroxide solution from water treatment system operations, had entered the miscellaneous waste system through the plant floor drain system, resulting in high conductivity of the processed waste stream through chemical depletion of the resins. The high conductivity of the processed water and the known volume of waste which had been processed resulted in a licensee decision to replace three of the four ion exchange demineralizer resin beds.

No. 6 demineralizer vessel was lined-up on May 20, 1986, for resin removal. When the operations personnel began the "sluicing" operation to remove the resin bed, they noted that resin could not be seen through the sight glass. The use of approved procedures for removal of "caked" or "packed" resins produced no results. When volume measurements indicated that no resin was present in the vessel, the vessel was removed from the system beginning May 23, 1986, moved over the shield wall to an accessible location, and on May 28, 1986, a connection on the top of the vessel was removed and a visual observation confirmed that no resin was present.

A test was then made to determine if the internal filters had failed and if the resins could have escaped to the ECST. Five cubic feet of resin was sluiced into the vessel in accordance with the normal procedure. At about the time sluicing was completed, e.g., about five minutes from the start of operation, resin was observed to be coming out of the vessel drain line, which had been directed into a "bag" filter. Licensee representatives

stated that flow in the drain line was then stopped, the drain line connection transferred to a resin-disposal high-integrity-container (HIC) and the flow of water into the demineralizer vessel was continued. In approximately 15 minutes, all of the five ft^3 of resin had passed through the system retention filters and was sluiced to the HIC.

Since it was apparent that either a filter failure or other release path had developed, the licensee subsequently shipped the vessel to the vendor for determination of the cause for the resin loss.

The licensee's preliminary evaluation concluded that a loss of resin had occurred at some point in time between August 1985, and May 16, 1986. The licensee reviewed all available records in an effort to determine the underlying causes, the most likely period or periods in which resin was lost, and the extent of radioactivity which could have been present on the lost resins. None of the available data could be interpreted as providing positive specific information as to the exact date or nature of the event/events which led to the loss of resin.

The operating log for Vessel 6 shows influent and effluent measurements and analysis results for pH, conductivity, total radioactivity concentration, and isotopic concentration. Pressure drop instrumentation, which had been installed with the equipment, had been fouled approximately two years earlier during system demonstration testing and had not produced valid data since that time; both the vendor and licensee had not been able to correct the instrumentation problems which involved particulate clogging of capillary lines and therefore, the pressure drop instrumentation readings, which were not required by regulatory criteria, were not recorded on the system logs.

System effluent during the entire resin load cycle (August 1985 - May 1986) was in the range of 10^{-4} to 10^{-6} uCi/ml total activity. Overall system decontamination factors ranged from about 10^2 to 10^3. The input radioactivity concentration to the No. 6 vessel resin bed was approximately the same as the output over the entire cycle. Ratios of output activity to input activity varied from 0.1 to 49 but most values ranged from 0.7 to 1.67 (49 out of 64). Based on the statistics of random probability, the reported DFs for the vessel are clustered in a Gaussian probability curve centered on a DF of 1.0, which is indicative that either the vessel resins were totally ineffective against the influent stream or there was not a resin bed present during any of the resin load cycle.

In view of the demonstrated loss of resins during the test, where 5 ft^3 of resin escaped from the vessel in about 15 minutes under conditions where water pressure was probably only a fraction of normal system operating pressure, it is likely that the resins would have been completely flushed out of the vessel during the first hour or so of the first run, not the last, and that any activity accumulation on the resins would have been negligible.

The suspect vessel was shipped by the licensee to a facility of NUS, the original vendor. On August 19, 1986, the vendor completed cutting open the vessel. On a preliminary investigation, it was noted that two of the six Johnson filters were loose enough to be turned by hand. One of the two loose filters appeared to be "tipped" slightly, to the extent that the investigator could insert the end of a 1/16" Allen wrench under about 1/2 (180°) of the filter, between the plenum or base plate separating the resin from the water chamber at the bottom of the vessel. A full examination had not been completed by August 21, the last day of the inspection. (During a telecon between licensee and Region II personnel on August 25, 1986, the results of the vendor's examination of the demineralizer vessel and related conclusions were discussed. The vendor discovered that an internal mounting bracket had been welded into place slightly off-center. The vendor concluded that the Johnson filter had been forced to seat properly, inducing some amount of stress in the assembly. At some point, the stress energy was released and the filter assembly shifted from its seated position and allowed resin to bypass the filter. Further investigations are planned to evaluate the impact of this manufacturing defect on the other five demineralizer vessels.)

The method of mounting of the Johnson filters appeared to be secure. A threaded 1/4" stainless steel bolt (stud) protrudes through the center of the filter, which is held in place by two nuts which are first tightened down against the filter body, with the first and second nuts being tack-welded together and the upper nut being tack-welded to the stud. With such an arrangement, it appears highly unlikely that vibration or the action of water pressure would disturb the orientation of the filter. While the unit could be accessed through the ports at the top of the vessel, it is unlikely that any device could have been introduced which would cause physical damage or movement of the filter. Based on the licensee's description of the history of the unit and its placement in a high radiation area behind a shield wall, it is likely that the filters have not been touched by other than system water and resin beads for about three years.

After reviewing all records concerning the incident and reviewing licensee corrective actions, the inspectors concluded that the licensee reacted in an appropriate manner. Short-term corrective actions were initiated immediately, the resident inspector was notified, and a thorough investigation was initiated. Release of ion exchange resin to the environment is not considered good practice and there is no direct evidence that the resin was released, but indications are that it was. The release records and conservative calculations of the activity deposited on the resin indicate that even if all the resin had been released at one time, no regulatory limits were approached. If the resin was released to the discharge canal, soon thereafter the radioactivity would have been leached out by the salt water.

This incident meets the criteria for a licensee identified event and no enforcement action is required. The final corrective actions, along with a failure analysis report to be provided by the vendor, will be reviewed during a future inspection (50-302/86-28-01).

5. Inspector Followup Items (92701)

(Closed) IFI 84-07-04 - Heat Traced Containment Air Sample Lines for Post Accident Sampling System. The inspector reviewed licensee modifications record and found that the heat tracing has been scheduled for the 1987 refuel outage. The installation of heat tracing will be reviewed after the outage (50-302/86-28-02).

(Closed) IFI 85-05-04 - Heat Tracing of Containment Air Lines (see above).