ENCLOSURE 1

SPECIAL INSPECTION TEAM

U. S. NUCLEAR REGULATORY COMMISSION

DRESDEN UNIT 1 POTENTIAL FUEL POOL FAILURE

JANUARY 25, 1994

INSPECTION REPORT NO. 50-010/94001(DRSS)

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U.S NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-010/94001(DRSS)

Docket No. 50-010 License No. DPR-2

Licensee: Commonwealth Edison Company
Opus West III
1400 Opus Place - Suite 300
Downers Grove, IL 60515

Inspection At: Dresden Nuclear Power Station, Unit 1
Morris, Illinois

Conducted: January 27 - February 18, 1994

Inspectors: R. Dudley, Assistant Team Leader, NRR
S. Brown, NMSS
P. Erickson, NRR
M. Kunowski, RIII, DRSS
M. Leach, RIII, DRP
M. Miller, RIII, DRP
T. Reidinger, RIII, DRSS
L. Thonus, NRR

Approved By: J. W. McCormick-Barger
J. W. McCormick-Barger, Team Leader
4/14/94
Date

J. W. McCormick-Barger for
John A. Grobe, Acting Chief
Reactor Support Programs Branch
4/14/94
Date

Inspection Summary

Inspection from January 27 - February 18, 1994 (Inspection Report No. 50-010/94001(DRSS))

Areas Inspected: Special inspection conducted in response to the determination on January 27, 1994, of the potential for a failure of the integrity of the Unit 1 spent fuel pool (SFP). The inspection included: a sequence of events validation; an evaluation of the licensee's actions to clean up the spilled water inside containment; a walkdown of the SFP and fuel transfer system configuration and condition to determine if other fuel pool draining vulnerabilities existed; an evaluation of the licensee's assessment of the potential radiological consequences of a SFP draining event; a review to determine if the emergency preparedness program adequately addressed a SFP draining event; a review of major systems in Unit 1 to determine if other design vulnerabilities existed that could result in pool draining or spills of radiologically contaminated water; an inspection of the compliance with the Unit 1 Technical Specifications and Decommissioning Plan; an evaluation of the

licensee's oversight of Unit 1; a review of the licensee's internal investigation of the Unit 1 event; and a review of the licensee's preliminary proposed actions to address weaknesses identified as a result of this event. Results: An executive summary of this special inspection is contained in Section 1 of this report.

DETAILS

1.0 Executive Summary

On January 24, 1994, the licensee discovered a leak in a service water line located in the Unit 1 offgas filter building. This leak was due to a rupture of the service water piping located in the unheated building due to freeze damage. To isolate and repair this leak, the licensee shut down the entire Unit 1 service water system. On January 25, 1994, during a routine quarterly radiation survey, the licensee discovered approximately 55,000 gallons of water in the basement of the unheated Unit 1 containment. This water originated from a rupture of the service water system inside containment also due to freeze damage to the system. Had the service water not been isolated as a result of the January 24 service water rupture, the volume of water inside containment would most likely have been much greater, possibly challenging the structural integrity of the containment structure.

Following identification of the ruptured piping inside containment, the licensee identified that there was a potential for a freeze damage failure of the portion of the fuel transfer system located inside containment. This could have resulted in the partial draining of the SFP which contained 660 spent fuel assemblies. Subsequent examinations revealed that the transfer system had not been damaged. The licensee took actions to guard against future freezing and formed an investigative team to review the event.

The NRC formed a Special Inspection Team to review and evaluate the circumstances and significance of this event. The inspectors identified that following permanent shutdown of the Unit in 1978, there was a progressively worsening pattern of management neglect at the facility. Little senior management attention was directed at the facility during the last 10 or more years resulting in a significant decline in its material condition. Licensee submittals of Decommissioning Plan information to the NRC reflected a significant disconnect between information and commitments provided and actual conditions and configuration of equipment and programs at the facility. These problems appeared to be a result of a lack of a dedicated and knowledgeable Unit 1 staff and appropriate management oversight. Specific findings identified during the inspection are summarized below:

1. Failure of the 42-inch fuel transfer tube could have rapidly drained the SFP to a level several feet below the top of the fuel bundles. Dose rates at the edge of the SFP could have been as high as 800 rem/hour (8.0 Sieverts/hour (Sv/hr)). At other locations within the site boundary, dose rates could have been lower, but still significant from scatter radiation. Dose rates in the shielded Unit 2/3 control room would likely have been less than or equal to 1 millirem/hr (0.01 mSv/hr). Offsite dose rates would also have been minimal. However, a more likely event would have been the freeze and rupture of the 8-inch bypass line, at or

above the bypass valve, associated with the vertical fuel transfer tube. This would have resulted in the fuel pool being drained down to a level just above the top of the fuel. Dose rates at the edge of the SFP would have ranged from 3 to 35 rem/hr (0.03 to 0.35 Sv/hr) for this event.

2. The immediate actions taken by the licensee to address the potential failure of the transfer tube were adequate. These actions included:

   - Installing the SFP gate to isolate the fuel transfer system from the SFP and visual inspection of the gate seals.

   - Performing a visual inspection of the transfer tube inside containment; the licensee identified no damage.

   - Installing portable heaters near and temperature monitors on the transfer tube. Temperatures were checked every eight hours.

   - Forming a 13-person investigative team lead by a corporate officer to review the event.

3. The inspectors identified that there were several lines in the SFP associated with the abandoned original pool cleanup and cooling system. These lines represented potential siphon paths that could drain the SFP. The licensee verified that isolation valves associated with each line were closed and tagged out-of-service, or, in one case, the licensee drilled a hole in a line to assure that no immediate siphon threat existed. The design of a new, soon-to-be-installed cleanup system was reviewed by the inspectors and found not to have siphon protection. The licensee subsequently revised the design and adequately addressed the concern.

4. The SFP water quality was poor. In December 1983, the original SFP cleanup and cooling system was permanently shut down because it had significantly degraded and cooling was no longer needed. By 1987, water quality had significantly declined and a large microorganism growth developed. During this time frame, the NRC transmitted to the licensee an allegation received by the region concerning the fuel pool water quality. As a result, the licensee evaluated the potential impact of microbiologically-induced corrosion (MIC), but identified none. Following a treatment of hydrogen peroxide to kill the growth, a new temporary cleanup system was installed. This system proved to be inadequate and water quality at the time of the inspection remained poor. Conductivity was high at 15 micromho/centimeter (the Technical Specification (TS) limit is 10) and the radioactive cesium concentration was also high at 1×10^{-2} microcuries/milliliter (μCi/ml) (370 Becquerels/ml). The high cesium concentration was apparently from leaking fuel pins in approximately 90 fuel

bundles. The new cleanup system discussed in item 3 above was expected to bring the conductivity in line with the TS limit and to lower the cesium concentration by a factor of 100 or more.

5. The fuel transfer tube visually appeared to be undamaged; however, the licensee's engineering evaluation concluded that the system could have frozen. Subsequent ultrasonic and visual examination by the licensee identified no indication of damage or excessive corrosion.

6. The licensee had no SFP leak detection or water inventory program, but the inspectors identified no specific evidence that the SFP was leaking. However, at the inspectors' request, the licensee began recording water additions to the SFP and developed an evaporation study to determine net SFP water loss. The adequacy of the licensee's SFP leakage monitoring program will be reviewed during a future inspection. To bound the magnitude of potential releases, the licensee performed an analysis assuming all the SFP water was to be instantaneously released to the river. The results of the analysis indicated that the exposure to the public from such a release would be within the requirements provided in 10 CFR 50, Appendix I, for normal power plant effluent releases.

7. The inspectors identified a number of isolated, water-charged lines located outside of containment that, if inadvertently unisolated, could have provided a direct path to flood the containment or could charge lines in containment that could possibly later freeze, rupture, and cause containment flooding. These systems were verified to be isolated, but the associated valves were not locked or administratively controlled by a "red tag" system. A followup NRC inspection will be performed to review control of these valves.

8. The inspectors reviewed TSs, Decommissioning Plan line items, and other licensee submittals to the NRC to determine if Unit 1 was being maintained as committed to and as required. A number of concerns were identified that indicated that the facility was not well managed and that adequate safety reviews were not always performed to assure that the plant and stored fuel remained in a safe configuration. The following were examples of these concerns:

   - The Decommissioning Plan (Plan) stated that a Project Manager was assigned with the responsibility for managing the on-site Unit 1 project staff. The inspectors were told by the licensee that no Project Manager had been assigned this responsibility. In addition, the staff that was assigned responsibility for Unit 1 had significant Units 2 and 3 responsibilities. The licensee assigned a Project Manager to the facility prior to the inspectors' exit.

- A number of systems designated in the Plan as operational were determined to not be operational. These systems included the containment heating and ventilation systems. Although the wording in the Plan allowed the licensee one year after the NRC's approval of the Plan on September 3, 1993, to bring the plant into compliance with these statements, the licensee had taken no significant steps to restore these systems or to remove from the Plan the requirement to have them operational.

- In a letter to the NRC dated May 18, 1989, the licensee committed to install an Eberline model SPING-3A (System-Level Particulate, Iodine, and Noble Gas) air monitor in the fuel storage building by March 1991. The monitor was installed shortly after this time, but subsequently was taken out-of-service. The licensee returned it to service, revised associated procedures, and completed testing of the monitor prior to the end of the inspection.

- In a letter to the NRC dated October 30, 1993, the licensee stated that the primary piping systems as well as the majority of the balance of plant systems had been drained and that other systems that could contain fluids were properly laid up and would not be challenged by temperature extremes. The inspectors learned that the service water system had not been properly laid up, and ruptured as a result of freezing temperatures in containment. Furthermore, the vertical fuel transfer tube had not been laid up and was susceptible to freezing and rupturing.

- The licensee's Offsite Dose Calculation Manual (ODCM) listed the ventilation exhaust flow rate for the containment as 7200 cubic feet per minute (cfm) and the ventilation exhaust flow rate for the fuel storage building as 5,200 cfm. The inspectors were told that the containment ventilation had been shut down for several years and that the flow rate for the fuel storage building was 2000 cfm.

9. Because of previous freeze damage to the containment heating/cooling units, the licensee discontinued heating the containment, but did not perform an adequate 10 CFR 50.59 evaluation. The licensee evaluated the effect of no heat on the containment shell, fire protection system, area radiation monitors, electrical distribution system, and sumps and drain tanks located inside containment. However, the licensee accepted incorrect assumptions concerning the status of piping and components located inside containment without verifying that they were properly laid up.

10. The audit program was conducted on a site basis and not a Unit-specific basis. Audits tended to focus on the operating Units and covered very few Unit 1 activities.

11. Past oversight of Unit 1 was not adequate. As mentioned above, assigned staff had significant responsibilities for Units 2 and 3. Funding for Unit 1 during the last few years appeared to have been adequate; however, workers had to be obtained from Units 2 and 3. Unit 1 usually received low priority and much of the planned work was delayed.

12. The licensee's response to this event was mixed. Although the efforts of the licensee's investigative team were very good, senior site and corporate managers were not active participants in the identification of the many problems identified by their investigative team. For example, at the time of the NRC exit meeting, few if any managers had toured the Unit 1 containment or fuel pool to see first hand the scope of the problems at the facility.

    The licensee's investigative team provided the inspectors with an excellent briefing of the event and their preliminary findings upon the inspectors initial arrival, and provided continuous support during the inspection. Their final exit meeting with site management included the identification of many weaknesses in the management of the facility, training, engineering and licensing support, and staff attitude. The licensee's team concluded that an underlying cause of the event was that many Dresden staff believed that Unit 1 could not cause a serious safety problem and therefore the facility received little attention.

Several apparent violations were identified during the inspection, as listed below.

- One apparent violation with two examples for changing the containment heating and ventilation systems as described in the Hazards Summary Report without performing a 10 CFR 50.59 safety evaluation.

- One apparent violation with three examples for not maintaining the facility in accordance with licensee documents incorporated into the license. The three examples were not maintaining the containment heating and ventilation systems, the lack of an assigned Project Manager, and the improper lay up of the fuel transfer tube and the service water system.

In addition, an apparent deviation was identified for the missed commitment to install and operate the SPING-3A air monitor, and several Inspection Followup Items were identified.

2.0 Sequence of Events

The sequence of events was developed from information compiled by the licensee's team and from independent review of records and discussions with plant personnel.

On Monday, January 24, 1994, at about 3:00 p.m., a radwaste operations supervisor noted a higher than expected level of water in the Unit 1 turbine building drain tank. The input to the drain tank was traced to the Unit 1 hotwell sump and a search for the source of the input to the sump began.

At about 7:35 p.m., an equipment attendant found three inches of water in the Unit 1 offgas filter building and water spraying from two 3-inch valves on the Unit 1 service water system. The service water pumps were subsequently secured which stopped the leaks. This water was determined to be the source of the input to the sump via floor drains in the building. Approximately 18,000 gallons of water leaked from the valves before the pumps were secured. The cause of the leaks was freeze damage to the valve bodies.

On Tuesday, January 25, 1994, at approximately 10:00 a.m., radiation protection personnel who were conducting a quarterly survey in the Unit 1 containment observed over two feet of standing water on the basement elevation (488-foot). The licensee's investigation of the source of the water began.

On Thursday, January 27, 1994, at approximately 9:45 a.m., the licensee began pumping the water with two temporary pumps to a containment drain tank from where it was pumped to an Unit 1 underground radwaste tank. Also that day, the event was discussed with the licensee's Unit 1 decommissioning group, which was conducting a routine meeting. This group determined that the low temperatures may have jeopardized the integrity of the 42" fuel transfer tube near an isolation valve and an associated 8" bypass line and its valve. The fuel pool gate was subsequently installed. In addition, the NRC Senior Resident Inspector (SRI) was informed of the situation and conducted an inspection of the fuel pool and the containment. After a question from the SRI about emergency makeup water for the pool in case the tube failed and water began to drain from the pool, the licensee moved four water hoses to poolside.

On Friday, January 28, 1994, a Region III senior radiation specialist arrived at Dresden to assist in the initial NRC review. Licensee walkdown of containment identified freeze damage to three 14" valves and two heat exchangers on the service water system and an 8" pipe on the contaminated demineralized water system. The temperature of the transfer tube above the isolation valve was approximately 36 degrees Fahrenheit (° F) and 63° F below the valve. A portable radiant heater was installed near the valve and the temperature of the transfer tube was monitored shiftly (every 8 hours).

On Saturday, January 29, 1994, the temperature of the transfer tube above the valve was 43° F and 73° F below the valve.

On Monday, January 31, 1994, removal of water from the basement was nearly completed. Based on the change in the level of the Unit 1 outdoor radwaste tank (T-114) to which the water was pumped from the underground tank, the licensee estimated approximately 55,000 of service water had spilled in containment.

On Monday, February 7, 1994, the full NRC Special Inspection Team arrived at Dresden (the Team's charter is Attachment 4).

On Wednesday, February 16, 1994, ultrasonic testing of the transfer tube identified no damage to the transfer tube or isolation valves. The temperature of the transfer tube above the valve was 77° F and 89° F below the valve.

On Friday, February 18, 1994, the NRC Special Inspection Team conducted an exit meeting with licensee management and summarized the purpose and findings of the inspection.

3.0 Water Spill at Dresden Unit 1

The January 24 spill of water to the Unit 1 offgas filter building was apparently caused by freeze damage to two 3" service water valves. The damage likely occurred during the previous week when outdoor temperatures fell below 0° F and portable heaters for the building were inoperable or unavailable. The approximately 18,000 gallons of water that leaked from the damaged valves were contained within the building's concrete curbing and drained through floor drains to the Unit 1 hotwell sump. The licensee stopped the leak by securing the service water pumps. The pumps remained off through the end of the inspection. Eventually, operable heaters were installed in the building and the valves were replaced.

Securing the pumps on January 24 likely terminated the leak of service water in containment, identified on January 25. The large volume of water in containment inundated and rendered inoperable the sump pump located in the undervessel area. Consequently, two temporary pumps were used to pump the water from the basement to two floor drains on the 502' elevation where it drained to the 5000-gallon capacity "A" reactor enclosure drain tank (REDT) located in the basement. From the REDT, the water was pumped via the Unit 1 radwaste underground pipe tunnel to an underground Unit 1 radwaste tank, and then to T-114, an outdoor, aboveground Unit 1 radwaste tank. Based on the level change in T-114, the licensee estimated that 55,000 gallons had leaked into the Unit 1 containment basement.

3.1 NRC Review of Clean Up

The water in T-114 was to be sent via the Unit 1 radwaste tunnel to the Unit 2/3 radwaste processing system for treatment and re-use or discharge. Because the Unit 1 service water was taken from the river with little or no treatment, the water had high conductivity and high organic material levels. The licensee stated that in order to minimize depletion of the Unit 2/3 demineralizers because of this low quality water, it would be processed in batches of only several thousand gallons. The licensee indicated this would not be a problem.

The inspectors noted that the water in T-114, which was uninsulated, was being continually recirculated in the tank because the tank's heaters could not be used. In response to the inspectors' concern about the water in the tank freezing and rupturing the tank, the licensee installed thermocouples to monitor tank water temperature. Discussions with the licensee and a review of records indicated that a problem with at least one of the two tank heaters was documented in a work request dated December 6, 1992, and concern about the tank's contents freezing because of faulty heaters arose in December 1991 (Inspection Reports No. 50-237/91039(DRP); 50-249/91043(DRP)). Temperature readings during the inspection period identified that the tank water temperature was well above freezing, even during sub-zero weather.

3.2 NRC Radiological Measurements

On January 28, 1994, a sample of water from the basement was analyzed by the NRC Region III Laboratory to verify the licensee's sample analysis results. Good agreement between the data was obtained. The predominant isotope was cesium-137, present at a concentration of approximately 1×10^{-4} μCi/ml (3.7 Bq/ml). Also, Cobalt-60 (at 2×10^{-5} μCi/ml (0.74 Bq/ml)) and cesium-134 (at 2.5×10^{-7} μCi/ml (0.00925 Bq/ml)) were present.

External exposure dose rate measurements were also made by the inspectors in containment. The results agreed with licensee survey data. Generally, the dose rates were low, less than several millirem/hour. One notable exception was on the 502-foot elevation by the transfer tube valves. The dose rate on contact with the tube was approximately 3 rem/hr (30 milliSievert/hr (mSv/hr)) and at about one foot from the tube was 200 mrem/hr (2 mSv/hr).

3.3 Containment Clean Up Plans

The leak in containment caused the spread of asbestos-containing insulation and radioactive contamination on the 488-foot (the basement), 502-foot, and 517-foot elevations. In the basement, where radiological conditions changed the most, the water moved contamination out from the sump and several highly contaminated rooms into the general walkways. General area contamination levels increased from less than 1000 disintegration per minute per 100 square centimeters (dpm/100 cm^2) to a range of 35,000 dpm/100 cm^2 to 100,000-500,000 dpm/100 cm^2. For several days after the water was pumped out, the basement and the 517-foot elevation remained wet and airborne radioactivity remained low, but after the areas dried, airborne radioactivity increased to almost 1 derived air concentration (DAC), mainly of unidentified alpha emitters (Unit 1 experienced fuel failures during part of its operating life). Much of the 502-foot elevation also dried, but two plugged floor drains prevented one large area from drying (survey and work request records indicated that these floor drains had been plugged for at least one year). Because cold air temperatures in containment would freeze water used for decontamination (decon) and represent a personal comfort and safety concern, the licensee delayed full decon efforts until mid-April.

Until then, unplugging of the floor drains and some clean up or containment of asbestos was planned. In addition, the fuel transfer tube and valves would be monitored routinely from the 529-foot elevation using a video camera and remote thermocouple readouts. An initial plan to have entrances and openings from the 502-foot to the 517-foot elevations sealed in plastic was discarded after surveys indicated little if any migration of airborne radioactive material and asbestos. A followup inspection of the results of the licensee's efforts to clean up the loose contamination resulting from the spill will be tracked as an Inspection Followup Item (IFI No. 50-010/94001-15(DRSS)).

3.4 Root Cause of Spill

The root cause of the spill was the failure to maintain the air temperature in containment above 32° F. According to licensee representatives, and a review of Section D.13. of the Dresden 1 Hazards Summary Report (the Final Safety Analysis Report) and the Unit 1 Equipment Manuals, heat was originally provided to the containment mainly by a steam supplied, hot water system and, secondarily, by steam heating the supply air of the ventilation system. A boiler in the Unit 1 boiler house provided the steam for the water-coil heated unit coolers and associated heat exchangers of the hot water system, located in containment. A steam line associated with the containment ventilation supply fans located in the auxiliary bay building provided the heat for the supply air.

After the spring of 1989, the licensee retired the Unit 1 boiler because it was unlikely that it could pass a required ASME (American Society of Mechanical Engineers) pressure test. Instead, the licensee decided to supply the necessary heating steam to the Unit 1 containment by means of an existing cross-tie from the Unit 2/3 boilers. However, because of previous freeze damage to the containment heaters and the large amount of resources necessary to repair this damage and maintain the containment portion of the heating system, heating steam was not provided to containment after the spring of 1989, and for any subsequent heating season. In addition, according to the licensee, the ventilation system was shut down several years ago (a specific date was not available), eliminating that source of heat to containment. Heating steam was provided to the ventilation system via the cross-tie to the Unit 1 crib house and the fuel storage and turbine buildings.

The licensee had several safety evaluations performed to determine the effects of terminating the heating of containment; however, these were limited in scope and were based on the erroneous assumption that the piping systems located within containment were isolated and drained. The failure in or about 1989 to adequately evaluate the effects of changing the hot water heating system, as described in the Hazards Summary Report, is an example of an apparent violation of 10 CFR 50.59 (No. 50-010/94001-01a(DRSS)). The failure to adequately evaluate the effects of changing the ventilation system, as described in the Hazards Summary Report, is another example of an apparent violation of 10 CFR 50.59 (No. 50-010/94001-01b(DRSS)).

4.0 SFP and Fuel Transfer System Configuration and Condition

The SFP and fuel transfer system consisted of two in-ground pools (the SFP and the transfer pool), an underground horizontal transfer tunnel, and a vertical transfer tube (see Figures 1 & 2). The construction material for the pools and the horizontal transfer tube was an epoxy coated concrete.

The SFP provided non-seismic storage for 669 assemblies with 660 fuel assemblies currently being stored. The pool was 25 feet deep with the top of active fuel at approximately the 505-foot elevation and the normal water level at approximately the 520-foot elevation (pool held approximately 100,000 gallons of water). Space was provided in the SFP for control rods; however, they were currently stored in the transfer pool and were in the process of being shipped offsite for burial. Three positions were available in the SFP to hold fuel transfer racks, although the positions were never used (each fuel transfer rack could hold 4 fuel assemblies). The SFP could be isolated from the transfer pool by a 4-foot wide by 27-foot deep, two-piece fuel pool gate. According to the licensee, the gate was usually not installed between the pools. It was re-installed, however, after the spill in containment was discovered.

The transfer pool provided: space to manipulate fuel assemblies and load shipping casks, storage locations for 3 fuel baskets (each basket could hold 4 fuel transfer racks), and the space to load fuel baskets and place them into the fuel basket carrier. Three fuel baskets were stored in the transfer pool. One basket held 12 fuel assemblies, another held 11 fuel assemblies, and a third was stored empty in the fuel basket carrier. The transfer pool was 40 feet deep with the top of active fuel at approximately the 490-foot elevation (transfer pool held approximately 157,000 gallons of water).

The horizontal transfer tunnel connected through the bottom of the transfer pool wall and extended to the opposite wall of the pool, creating a water depth of 45 feet. The tunnel was 15 feet high and 59 feet long with the top of the tunnel 27 feet below ground level. A rail on each side of the tunnel provided the path for movement of the fuel basket carrier. The carrier was moved by a cable system and sealed to the vertical transfer tunnel via a bellows during fuel transfer.

The vertical transfer tube had an outside diameter of 42 inches and was constructed of 0.5-inch thick carbon steel. The tube extended downward approximately 55 feet from the fuel handling canal, in containment, to the top of the horizontal transfer tunnel. A bolted cap on the top of the tube provided one barrier for containment isolation and the combination of a 42-inch motor operated isolation gate valve at the 505-foot elevation with an 8-inch motor operated bypass valve at the 506.5-foot elevation provided the second barrier.

4.1 Licensee Immediate Actions to Address Freeze Vulnerabilities

If a freezing failure occurred at the vertical transfer tube, the worst scenario would be freezing at the basement floor location where the transfer tube came up from the horizontal tunnel at an approximate elevation of 502 feet. While the top of active fuel for the 23 fuel assemblies in the transfer pool would remain covered with 12 feet of water, the 660 fuel assemblies in the storage pool would have been uncovered by about 3 feet. A more likely event would have been a rupture of the bypass line at or above the bypass line isolation valve which could have resulted in dropping the SFP water level to about 1 to 2 feet above the top of active fuel (TAF).

To prevent the freezing potential, the licensee installed an electric radiant heater at the 502-foot elevation to heat the vertical transfer tube. A backup heater supplied from a separate motor control center (MCC) was staged in the area. Each MCC could be powered from two separate transformers (4Kv to 480v) with all four transformers being fed from transformer 12 (138Kv to 4Kv). Should transformer 12 become unavailable, an operating procedure (OP 6500-2) was available to provide power from transformer 13 (34Kv to 4Kv). Thermocouples were placed above and below the 42-inch gate valve on the opposite side of the tube from the radiant electric heaters. Daily orders required each shift to use the remote camera to visually inspect the fuel transfer tube. Remote thermocouple readings of the transfer tube temperatures were also required to be logged once per shift. In addition, the licensee installed the fuel pool gate between the two pools which provided another barrier to prevent the potential draining of the SFP pool.

An ultrasonic test (UT) of the vertical transfer tube was performed by the licensee. The UT found no pitting of the tube and no freeze damage. The results of this testing were to be used as a baseline for future periodic monitoring of tube integrity.

4.2 NRC Assessment of SFP and Transfer System

Two additional scenarios were identified that could cause a rapid loss of fuel pool water inventory. The first would be opening of the vertical transfer tube 42-inch gate valve or the 8-inch bypass valve in conjunction with a leak path from the vertical transfer tube. This scenario would hold true for faults in the tube from the 505-foot elevation up to fuel pool level (520-foot elevation). The second scenario was siphoning water through existing piping in the pool.

In the first case, both the transfer tube gate valve and the bypass valve were documented as out-of-service (OOS) closed in 1988 and both breakers were tagged OOS open. During the inspection, the licensee reverified the valves were closed and that the breakers were open. New OOS cards were hung.

Visual inspection of the vertical transfer tube at both the 502-foot and 517-foot elevations indicated no damage. The pipe was in good condition and showed no evidence of freeze damage. The UT inspection also verified the pipes to be structurally sound. In addition, the transfer tube was found to be full of water above the valves and up to the level of the fuel pools. Therefore, opening either valve would result in an insignificant amount of pool water displacing any noncondensable gas voids that may exist below the valves. Based on the documented integrity of the vertical transfer tube, opening either valve would not pose a threat to the SFP or transfer pool water inventories.

In the second case, several installed pipes entered the pools and extended to various depths. The pipes interconnected with other pipes that exited the fuel storage building, resulting in potential siphon paths. In addition, should water level be lowered in the transfer pool, the SFP pipes could circumvent the fuel pool gate and siphon SFP water.

The licensee confirmed that valves associated with the pipes were closed and OOS tags were hung. All the valves checked were found in the closed position. One pipe did not have a valve and the licensee drilled a hole in the pipe to eliminate any siphon potential. The potential for the siphoning of SFP water was acknowledged by the licensee and permanent steps were to be taken to eliminate the potential. The permanent corrective actions to remove the siphon potential associated with installed SFP and transfer pool piping will be reviewed during a future inspection (Inspection Followup Item (IFI) No. 50-010/94001-02(DRSS)).

A new fuel pool filtration system (Section 4.3) was being modified, prior to installation, to address siphoning concerns with outlet spargers for both pools and to raise the submersible pump higher above the fuel. The system also incorporated a cutoff switch for the submersible pump, which would shut off the pump if the outlet flow returning to the pools decreased. The cutoff switch was protection from loss of water inventory from the filtration system. The proposed changes were acceptable. Incorporation of these changes and the issuing of procedural controls to ensure surveillance of the pump cutoff switch will be reviewed during a future inspection (IFI No. 50-010/94001-03(DRSS)).

The pools were inspected for other penetrations that could potentially cause loss of water inventory. The review included drawings, constructions photos, and a visual inspection of the pool walls and floors. No additional penetrations were identified. In addition, the underground radwaste tunnel that runs adjacent to the fuel pools and over the transfer tunnel was inspected. Water was found in the tunnel; however, licensee gamma spectroscopy analysis of the water indicated that it likely was not SFP water. Portions of piping in the radwaste tunnel that were still in use had significant surface corrosion. The licensee's resolution of the corrosion problem will be reviewed during a future inspection (IFI No. 50-010/94001-04(DRSS)).

4.3 SFP Water Clean Up System

In late 1983, the licensee experienced significant difficulties with the SFP cooling and filtration system. After many years of service, the heat exchangers developed tube leaks allowing service water to leak into the SFP system contaminating the clean demineralized water and affecting water clarity. The SFP pumps began leaking contaminated water onto the floor of the fuel storage building. Problems also developed with the SFP filter which was of the old "sock type" design and developed a hole in one of the tubes. Filter media (diatomaceous earth) began to leak through the filter and into the SFP, further degrading water quality. Since the spent fuel in the pool did not generate enough decay heat to warrant repair and operation of the heat exchangers, the licensee decided in December 1983 to permanently take the system out of service.

From 1984 until 1987, the stagnant conditions in the SFP led to growth of microorganisms which later led to concerns regarding MIC. The licensee began to evaluate the potential impact of MIC in June 1987 and in November 1987 received and responded to an allegation regarding MIC in the SFP (Inspection Reports No. 50-010/88002; 50-237/87040; 50-249/87039). The pool was initially treated with hydrogen peroxide in December 1987 to destroy the microorganisms and the pool bottom was subsequently vacuumed to remove resulting debris. Currently, however, water quality was poor and a film of sediment coated many surfaces within the pool.

Following the appearance of MIC, SFP water quality degraded and significant surface corrosion of metallic structures in the pool occurred, including the fuel racks and pool piping. Due to the concern for rack integrity, the licensee removed a sample of the rack in 1990 and sent it to a National Laboratory for evaluation. This resulted in two fuel assembly storage locations being lost, but verified that the racks were structurally sound. The evaluation did not definitively conclude that MIC caused the corrosion; however, the MIC had little-to-no effect on the fuel assemblies. Followup action by the licensee was to periodically monitor corrosion coupons and visually inspect representative fuel assemblies to evaluate potential corrosive effects from either MIC or the hydrogen peroxide treatment.

A poolside filtration/demineralization system was installed and operated between March 1989 and fall of 1993. This system was originally intended to be permanent, but because of performance concerns, it was installed in a temporary fashion. The system's demineralizer was never used for a long period of time because of its limited capacity and the difficulty in changing the resin. In addition, the cesium-137 concentration in the pool water was so high that a high radiation field was quickly created around the demineralizer during operatio

The licensee submitted proposed SAFSTOR decommissioning Technical Specifications (TSs) on November 1, 1989, for SFP water quality which did not become effective and could not be met until after an acceptable filter/demineralizer system was put into operation. Prior to

September 3, 1993, when the SAFSTOR TSs were approved by the NRC, the existing TSs did not contain any SFP water quality requirements. However, the licensee's efforts to install and make the filter/demineralizer system operable continued to be delayed. Ultimately, the licensee decided that the existing external filter/demineralizer system would not be acceptable and arrangements were made to design and procure a new system.

When the NRC inspection team arrived on-site in February 1994, the licensee had not yet accepted delivery of the new filter/demineralizer system. Delivery was scheduled for the week of February 7, 1994, but was delayed by the licensee so that it could be redesigned to address the new configuration of the SFP with the fuel pool gate installed (Section 4.6) and any siphoning potential. The installation and operation of the new system will be reviewed during a future inspection (IFI No. 50-010/94001-14(DRSS)).

4.4 Spent Fuel Accountability and Condition

4.4.1 Special Nuclear Material Accountability

The inspectors reviewed the licensee's Special Nuclear Material accountability records for Unit 1 spent fuel. No problems were identified. The detailed records indicated the location and identifying number of each fuel assembly for each year. The licensee performed yearly audits of fuel in which each assembly was identified by its serial number with an underwater television camera. A 1981 record identified 671 assemblies in the SFP plus a rod storage basket holding two full length rods and one partial (an upper 16-inch section) rod. The partial rod came from assembly UN-066, which with the lower section of the rod, had been transferred to the West Valley facility for reprocessing. The assembly was later returned after West Valley closed and currently resided in the Unit 3 SFP. The 1981 record also identified 12 assemblies in a transfer basket in the transfer pool.

The 1993 fuel inventory data was identical to the 1981 data except that 11 additional assemblies were transferred to a second basket in the transfer pool in 1989 to allow for testing of a piece of the spent fuel rack. This brought the numerical totals to the present value of 23 assemblies in the transfer pool and 660 assemblies plus the one rod storage basket in the SFP. An inventory was also performed during the inspection. No discrepancies from the 1993 data were found.

4.4.2 Criticality During a Seismic Event

Criticality control for the spent fuel appeared to be adequate. The inspectors reviewed a contractor's report dated January 15, 1987, that evaluated the potential for criticality following a postulated rearrangement of fuel in the SFP. The analysis supported a conclusion that K-effective (K_{eff}) would be less than 0.95 for the worst case accident involving a water-filled or dry pool.

The inspectors also reviewed a June 21, 1977, criticality analysis addressing the fuel transfer baskets. The report concluded that a worse case accident involving rearrangement of fuel in a basket loaded with any 16 assemblies would have a K_{eff} of less than 0.95 and, more likely, less than 0.80.

4.4.3 Water Quality and the Effect on Fuel

The licensee established a procedure (DTS 8101) for surveillance of fuel assemblies for potential corrosion following the hydrogen peroxide treatment. For the surveillance, representative samples of the three types of Unit 1 fuel (a General Electric assembly, a United Nuclear assembly, and an Exxon assembly) were videotaped before the hydrogen peroxide treatment (for a baseline) and then on a set schedule after the treatment. Six inspections have been done since the treatment and no significant changes from baseline have been identified.

In the most recent inspection, on July 7, 1992, maneuverability problems with the camera allowed only the top parts and upper portions of the outer walls of the three assemblies to be videotaped. No significant changes were observed. The licensee planned to correct the problems so that future inspections encompassed the full length of the assemblies. NRC inspectors observed no corrosion of fuel during their visual inspections of the SFP.

4.5 Pool Water Inventory and Leak Detection

The licensee had no way of determining if the SFP or transfer pool were leaking. There was no leak detection system and the existing ground water monitoring system was developed for the site with no specific well for monitoring potential leakage from the pools. In addition, the amount of water added to the pools was not being recorded nor was a record kept of how often the water was added. However, a licensee evaluation indicated that if all the water in the pools were released outside the site boundary, the postulated offsite dose from the water would be well below the guidelines of Appendix I, to 10 CFR 50.

In response to concerns by the inspectors about leak detection and water addition, daily orders were changed to require operators to document, in a computerized log sheet, any water addition to the pools. This was a temporary measure and may be continued or replaced by some other method. An evaluation of the expected evaporation rate of water from the pool was also completed by the licensee at the request of the inspectors and indicated an average loss ranging from 0 - 0.5 inch per day. The expected evaporation losses can be used in conjunction with the water inventory addition logs to determine any potential fuel pool leakage or trend. However, as of the end of the inspection, the licensee had not determined how this information would be periodically reviewed to monitor for leakage. The actions that the licensee takes to improve its environmental monitoring and water inventory programs will be reviewed during a future inspection (IFI No. 50-010/94001-05(DRSS)).

4.6 SFP Gate Installation and Configuration

The SFP gate was installed (on January 27, 1994) between the SFP and the transfer pool when it was determined that spent fuel could be partially uncovered if either the transfer tube, the isolation or bypass valves, or the bypass valve piping failed (from freeze damage). With the gate in place, a failure associated with the transfer tube would likely only result in the loss of water from the transfer pool and transfer canal. In a Confirmatory Action Letter (CAL), dated February 1, 1994, the NRC requested notification from the licensee if it intended to remove the gate within the next 30 days, and to provide within 30 days, a detailed description of the actions and safety evaluations performed to remove the gate in the future.

The gate is composed of two reinforced metal sections that were normally stored underwater in the transfer pool along one of the walls. The approximate dimensions of each section are: length - 13 feet, 6 inches; width - 4 feet, 7 inches; and thickness - 8 inches. The sections are installed end-to-end for a total length of 27 feet. The sealing capability of the installed gate was accomplished by compression of rubber gaskets on the edges of the gate. A rubber gasket on the bottom of each section sealed because of the weight of the section. A J-shaped seal rubber gasket along each vertical edge (facing the transfer pool) sealed because of water pressure when SFP water level was greater than that of the transfer pool.

The inspectors were concerned whether the gaskets were still within normal expected service life, because it appeared that the gaskets were the original equipment installed in the late 1950's, and had been subjected to the microbial growth, the hydrogen peroxide treatment, and relatively high radioactive cesium levels. The licensee's records showed that the bottom gasket on the top section of the gate was replaced on January 7, 1977. The reason for the replacement was not documented. The licensee also noted that its records of equipment repairs and replacements were not maintained much earlier than 1977. The licensee requested the gasket manufacturer to address the service life issues and to specify a suitable gasket replacement.

The inspectors also reviewed the special procedure written for the installation and removal of the gate (a procedure was not available for the January 27th installation). The procedure was adequate with one exception. Based on review of a design drawing ("Shop, Warehouse & Fuel Bldg., Misc Steel Details - Sh. 1," drawing number 142F392) and a visual inspection of the gate, the inspectors determined that the procedure did not preclude transposing the sections during installation. Transposing the sections is a problem because the top section had a cutout at water level that, if the top section was inadvertently installed in place of the bottom section, would allow the SFP to drain directly to the fuel transfer pool if the transfer pool drained. In response to this problem, the licensee agreed to revise the procedure to require independent verification that the sections were properly installed prior to initiating any activities that would reduce the transfer pool water level. A permanent plant procedure would be developed to replace the special procedure. The licensee also agreed to examine the mating surfaces of the edges of the sections, once the gate was removed, to ensure surface integrity.

Resolution of the gasket service life issue, implementation of the permanent procedure, and results of the examination of the section mating surfaces will be reviewed during a future inspection (IFI No. 50-010/94001-06(DRSS)).

5.0 Radiological Consequences of Inadvertent SFP Draining

Results of preliminary calculations of the radiological consequences of partial and total draining of the SFP were submitted to the NRC by the licensee in a letter dated February 3, 1994. These results indicated that with the SFP drained, the dose rate from direct radiation would be 2,712 rem/hr (27.12 Sv/hr) at poolside, and the dose rate from scatter radiation would be 0.16 rem/hr (0.0016 Sv/hr) at 400 meters from the center of the pool (near the site boundary). If the water only drained down to the top of active fuel (TAF), at approximately the 505-foot elevation, the poolside dose rate would be 1,337 rem/hr (13.37 Sv/hr). The scatter dose with pool water level at TAF was not calculated. During the inspection, the licensee indicated that if the water had drained to about 2 - 3 feet below the TAF--which would occur under one of the more credible accident scenarios (Section 4.1)--the direct and scatter radiation dose rates would be similar to those calculated for the pool completely drained.

A revision of the initial radiological consequences estimate was provided to the NRC in a letter dated March 3, 1994, (sent in response to the CAL). The dose rate at poolside with the SFP drained would be 797 rem/hr (7.97 Sv/hr) and with water at the TAF would be 529 rem/hr (5.29 Sv/hr). The dose rate from scatter radiation with the pool drained was calculated to be less than 2 mrem/hr (0.02 mSv/hr) at 451 meters (the closest point to the site boundary) from the center of the pool.

The revised calculations indicated that the offsite dose rate as a result of draining the SFP would be negligible. Similarity, the dose rate inside the Unit 2/3 control room would be minimal, less than 1 mrem/hr (0.01 mSv/hr), because of the shielding in the walls and ceiling of the control room. Dose rates in other general access areas of the plant, however, could range from several hundred mrem/hr to several rem/hr resulting in a significant onsite radiological hazard.

6.0 Emergency Preparedness Plans in the Event of SFP Draining

The Dresden Generating Stations Emergency Plan (GSEP) was reviewed to determine if it adequately addressed the possible radiological consequences of an inadvertent draining of the SFP. The GSEP provided for four classes of emergencies: Unusual Event, Alert, Site Area Emergency, and General Emergency. The classes ranged from least severe to most severe level according to the relative threat to the health and safety of the public and emergency workers. Threshold values of Emergency Action Levels (EALs) were used to change from one class to another.

For the partial (or total) draining of the SFP, EALs based on abnormal radiation levels, system malfunctions, or hazards in the plant could have been used to classify the emergency and initiate appropriate protective actions. For abnormal radiation levels, the annunciator response procedure for the "high radiation levels in the fuel building" alarm annunciator would require the Unit 2/3 control room personnel to order evacuation of the fuel storage building and lead to the EAL for an increase in radiation levels in the plant by a factor of 1000. This EAL would result in an Unusual Event declaration. Additionally, if increases in radiation levels impeded necessary access to operator stations, or areas containing equipment necessary for a safe shutdown, then an Alert declaration would be warranted.

For system malfunctions, the receipt of a valid control room annunciator alarm for loss of SFP level, would have warranted an Unusual Event declaration. If SFP inventory had decreased due to lack of timely, adequate makeup, and dose rates were greater than or equal to 60 mrem/hr (0.60 mSv/hr) in combination with an inoperable gaseous monitoring system or with visual observations of a rapid decrease in water level such that the fuel could become uncovered, then the appropriate EAL would have warranted an Alert declaration.

For the EAL based on hazards and other conditions, if in the judgement of the Emergency Director conditions indicated a potential degradation of the level of safety of the plant, then an Unusual Event would be declared. If conditions indicated actual or potential substantial degradation of the level of safety of the plant, then the Emergency Director could declare an Alert. Furthermore, if conditions continued to degrade and indicated actual or likely major failures of plant functions needed for the protection of the public then a Site Area Emergency declaration would be made.

In any scenario involving radiation levels warranting declaration of an Alert or higher, additional radiation protection technicians (RPTs) would be dispatched to survey around the fuel storage building and to set up barriers to prevent inadvertent access to high radiation areas. Access would be limited as long as radiological conditions warranted. If a Site Area Emergency declaration was made, protective actions taken would include an assembly of all onsite personnel in designated assembly areas. RPTs would also be dispatched to assess the radiological conditions in these areas.

With the postulated worst case scenario of uncovering a portion of the spent fuel, several emergency response facilities would be inside the predicted elevated radiation field. These facilities would include the technical support center (TSC) and the operational support center (OSC). The TSC functions to support the control room, assess plant status and potential offsite radiological impact, coordinate onsite emergency response efforts, determine EALs and protective action recommendations, and notify offsite support agencies. The OSC functions to support in-plant emergency equipment repair and offsite emergency tasks.

By procedure, evacuation of TSC and OSC personnel would be considered if potential whole body exposure of 100 mrem/hr (1 mSv/hr) or 1 rem (10 mSv) total effective dose equivalent (TEDE) was exceeded. Currently, as backup locations, the TSC and OSC personnel would go to the Shift Engineers office (adjacent to control room) and the Unit 1 battery area, respectively. If these areas were deemed to be unsuitable, other more suitable locations would be sought.

In conclusion, the Dresden GSEP was found to contain adequate provisions to respond to an inadvertant draining of the Unit 1 SFP.

7.0 Review of Other Design Vulnerabilities

The inspectors performed a safety review to determine if cold weather or any other mechanisms could adversely affect the safety of Unit 1 or result in the uncontrolled release of radioactive material to the environment. Included in this review was the potential for unmonitored releases from the fuel storage building. The inspectors also evaluated the material condition of the radwaste system and reviewed water level and radiation monitoring in the fuel storage building.

7.1 Review of System Drawings and Verification of System Layups

The inspectors evaluated the potential for liquid intrusion into the containment and for uncontrolled releases of radioactive material from the containment. The evaluation included a review of piping and instrumentation diagrams and plant walkdowns. The principal concern was the potential for a liquid-filled pipe in the containment to freeze and burst while it continued to be supplied from a source outside the containment. Additional concerns related to the potential for backflow in systems which drained the containment and unintentional flow through systems which are normally isolated outside the containment.

No piping supplied from outside containment was identified with a potential for freezing/bursting inside the containment other than the fuel transfer tube and the components which likely burst and leaked in late January 1994 (Section 2). No systems containing radioactive liquids were identified which could freeze/burst in a manner which would cause an uncontrolled release onsite or to the offsite environment. Any potential leakage from piping subject to freezing would be captured by drains and sumps.

The following penetrations had water-filled lines which burst during the January 24 event, but were currently isolated from supply sources outside the containment.

Penetration/Description

* H-30, a 14-inch service water supply - the system is currently shut down.
* H-31, a 14-inch service water return - the system is currently shut down.
* H-32, a 6-inch contaminated demineralized water supply line - this line had been cut and capped approximately 10 feet inside the containment. Although the line segment was water-filled, froze, and burst during the January 24 event, it was not pressurized.
* H-54, a 6-inch steam supply line from Unit 1 auxiliary boiler or Units 2/3 auxiliary boiler.

The following penetrations contained lines which were isolated from supply sources outside the containment by closed valves. The closed valves were not locked closed or administratively controlled by a "red tag" system. Inadvertent valve opening could subject these penetrations/piping systems to freezing/bursting or to flow through an undrained low point on the piping system which had previously frozen and burst. Such low point pipe breakage is likely to remain undiscovered until a leak occurs.

<u>Penetration/Description</u>

* H-62, a 2-inch filtered water supply line to the fuel transfer tube and the fuel handling canal.
* H-66, a 2-inch clean demineralized water supply for general service in the containment.

The following penetrations contained lines which were isolated from supply sources outside the containment by closed valves. The lines were open inside the containment. Inadvertent valve opening would likely result in direct flooding of the containment. The closed valves were not locked closed or administratively controlled by a "red tag" system.

<u>Penetration/Description</u>

* H-22/23, 6-inch drain lines from post-incident strainers which were tied to the fire water system.
* H-24/25/26/27/28/29, 4-inch supply lines to post incident spray headers; these lines are supplied from the fire water system.
* H-35, a 6-inch core spray line to the reactor vessel; the core spray system is supplied from the fire water system.
* H-55, a 6-inch core spray line to containment floor drains.

Representatives from the licensee's engineering organization stated that plans had been made to cut and cap several of the lines outside the containment. These included the service water system, contaminated demineralized water system, and the cross connections from the fire water system to the post-incident system.

The licensee had not decided on a course of action on the remaining penetrations at the completion of the inspection. This matter will be reviewed during a future inspection (IFI No. 50-010/94001-07(DRSS)).

7.2 Walkdown of Containment and Fuel Storage Building Ventilation Systems

Discussions with the licensee and a review of records indicated that the ventilation exhaust flow rate for the fuel storage building currently was 2000 cubic feet per minute (cfm). A modification underway during the inspection to add a fan, dampers, and HEPA (High Efficiency Particulate Air) filters was expected to increase the flow exhausting the building and entering the Unit 1 stack. In addition, a new, larger supply fan and steam heater were being added to the building's ventilation system.

During a review of the licensee's Offsite Dose Calculation Manual (ODCM), the inspectors noted that Figure 10-1 of the current revision (dated January 1993) listed the exhaust flow rate of the fuel storage building into the Unit 1 stack as 5200 cfm instead of the actual flow of 2000 cfm. The inspectors discussed this with licensee representatives who could not explain the discrepancy, but indicated the 2000 cfm value was accurate. In addition, the inspectors noted that the same figure in the ODCM listed the exhaust flow rate of the containment as 7200 cfm; however, according to the licensee, the containment ventilation system was permanently turned off several years ago. This issue is also addressed in Section 3.4 of this report. The licensee's revision of the ODCM to correct these values will be reviewed during a future inspection (IFI No. 50-010/94001-08(DRSS)).

7.3 Walkdown of Containment

The inspectors toured containment on February 14 and observed the material condition of containment penetrations H-30, H-31, H-32, H-35, H-43, H-44, H-45, H-47, H-55, H-62, H-66 and associated piping systems. The condition of the pipes and valves found damaged after the January 25 spill was also observed, as was the damage to heat exchangers in the containment air coolers/heaters. The inspectors verified that the flanged cover on the fuel transfer tube was inplace and observed the material condition of the fuel transfer tube. The position of the fuel transfer tube isolation valve and bypass valve and their associated breaker positions were verified as were the installation of thermocouples, camera, and radiant heaters (as discussed in Section 4.1).

Although the weather had warmed and ambient temperatures were above freezing, ice remained on the floors of all elevations. The general housekeeping and cleanliness of the containment was variable with the poorest conditions existing at the lower elevations.

7.4 Review of Liquid Radwaste System

The Unit 1 liquid radwaste system was used to collect and store floor and equipment drain inputs from Unit 1 buildings, collect the surface skimmings of the Unit 1 SFP, and to provide backup storage capacity for the Unit 2/3 radwaste system. Liquid radwaste generated by Unit 1 was processed by the Unit 2/3 radwaste system and discharged from the Unit

2/3 release point. Over the past several years, modifications have been done to facilitate moving radwaste between the Unit 1 and the Unit 2/3 radwaste systems. Notwithstanding these modifications, several examples were identified during the inspection where increased attention appeared necessary to resolve equipment problems. These examples were:

- recurrent problems with the T-114 heaters (Section 3.1),

- corrosion of pipes in the Unit 1 radwaste pipe tunnel (Section 4.2), and

- poor material condition of the Unit 1 radwaste control room, including the control panel.

7.5 **Review of SFP Water Level and Radiation Monitor Alarms**

Shortly after the integrity of the transfer tube became a concern, the licensee installed the SFP gate and functionally tested and verified the proper operation of the SFP low water level alarm. No problems were identified during the test; however, with the gate installed (a configuration that was atypical of past practice), the SFP water level instrument would likely not accurately monitor the water level in the transfer pool. As a compensatory measure, plant personnel entered the fuel storage building each shift and noted transfer pool level as indicated by numbered markings on one side of the pool.

At the request of the NRC, the licensee also functionally tested and verified the proper operation of the fuel storage building poolside area radiation monitor. This monitor was set to alarm at 60 mrem/hr (0.6 mSv/hr). No problems were identified during the test.

In the event of the postulated most credible scenario involving the draining of the SFP, it appears likely that appropriate alarms would have been received in the Unit 2/3 control room.

8.0 **Licensing Review**

On September 3, 1993, the NRC issued an order approving the Unit 1 SAFSTOR Decommissioning Plan and issued license Amendment No. 37 which approved and implemented the SAFSTOR TSs. License Condition No. 1. B. of Amendment No. 37 required the licensee to maintain Unit 1 in conformity with the licensee's application and the requirements of the NRC. License Condition No. 1. A. listed the application, dated January 7, 1986, and the 13 letters incorporated as a revision of the original application. The original application and the 13 letters also constitute the Decommissioning Plan. The inspectors reviewed the current status of the facility to ensure both compliance with and adequacy of the approved TSs and Decommissioning Plan. The results of that review are summarized below.

8.1 Technical Specification Review

Records of surveillances performed in accordance with TSs 3/4.8.B.2 - Service Water Discharge Liquid Effluents and 3/4.10.F - Fuel Storage Pool Water Quality were evaluated. Results of surveillances indicated that all existing TS requirements were met except for conductivity of SFP water. Licensee data showed that the conductivity of the SFP water had routinely exceeded the TS limit of 10.0 μmhos/cm. Discussions with the licensee revealed that the current TS on conductivity could not be met with the existing SFP filtration system. The basis provided by the licensee for TS 3/4.10.F indicated that the specification was not to become effective until the clean up of the SFP had been completed and the new filter/demineralizer system (Section 4.3) had been installed and was operable.

The inspectors also evaluated the adequacy of the current decommissioning TSs. Due to the unique design of the SFP and fuel transfer system, the inspectors concluded that special emphasis should be placed on the SFP low level alarm and the fuel storage building high radiation monitor, which annunciated in the Unit 2/3 control room. The inspectors observed that the licensee had no TS for calibration and testing of this instrumentation.

8.2 Decommissioning Plan Review

In the letter dated February 7, 1992 (listed in License Condition No. 1. A.), the licensee stated that the heating and ventilation systems for containment would be maintained, as required, during the approximately one year period after approval of the Decommissioning Plan (September 3, 1993), for continued use during the subsequent 30-year dormancy period. The inspection identified that as of September 3, 1993, these systems were not maintained. This is an example of an apparent violation of License Condition No. 1. B. (No. 50-010/94001-09A(DRSS)).

Also in the letter dated February 7, 1992, the licensee stated that a decommissioning Project Manager position, who was responsible for coordinating the actions of the on-site project team, the general office project team, and consultants and subcontractors, had been established and reported to the Vice-President level. The inspection identified that as of September 3, 1993, this position had not been established. This is another example of an apparent violation of License Condition No. 1. B. (No. 50-010/94001-09B(DRSS)).

In a letter dated October 30, 1992 (listed in License Condition No. 1. A.), the licensee stated that while the majority of plant systems have been drained, other systems that could contain fluids have been properly laid up and will not be challenged by temperature extremes. The inspection identified that as of September 3, 1993, the service water system and the fuel transfer tube contained fluids and had not been properly laid up to prevent challenge by temperature extremes.

This is another example of an apparent violation of License Condition No. 1. B. (No. 50-010/94001-09C(DRSS)).

In a letter dated May 18, 1990 (not listed in License Condition No. 1. A.), the licensee stated that an Eberline Model SPING-3A air monitor (SPING) would be operational by March 1, 1991, to locally monitor the fuel storage building and that communications between the SPING and the control room would be established by mid-1992. Contrary to this, the monitor was made operational in May 1991 and only for a short period of time. It was returned to service during the inspection. This is considered an apparent Deviation from a commitment (No. 50-010/ 94001-10(DRSS)).

The inspectors also reviewed the current status of 15 systems described in Section 6.3 of the letter dated February 7, 1992, as remaining operable during the SAFSTOR period. Information obtained from the licensee indicated that the current status of the cooling water system, instrument air system, and containment air conditioning water system differed significantly from the information provided in the letter. The final status of these systems will be reviewed during a future inspection (IFI No. 50-010/94001-11(DRSS)).

The inspectors also evaluated the adequacy of the Decommissioning Plan, particularly in areas related to the recent containment flooding. The inspectors concluded that a number of issues should be evaluated by the licensee as to whether they should be incorporated into the approved Decommissioning Plan. These issues include a discussion of SFP water inventory trending and resolution of all Decommissioning Plan discrepancies discussed above, including: (1) installation of the SPING in the fuel storage building, (2) operability of the fuel storage building and reactor containment ventilation systems, (3) updating the operability status of systems described in the Decommissioning Plan, and (4) updating the decommissioning organization chart.

9.0 Licensee Oversight

The inspectors evaluated the historical and current oversight maintained by the licensee for Unit 1 by reviewing audit records and by interviewing licensee personnel.

9.1 Historical Oversight

During the interviews and during a briefing provided by the licensee, licensee management personnel candidly acknowledged that a general attitude of disinterest had been allowed to develop in the mid-1980's when the SFP filter system was taken out of service and pool water quality seriously degraded. Licensee managers stated that attention had been mainly focussed on Units 2 and 3 during this time period. However, they also emphasized that in recent years, significant resources had been expended to improve the material condition of Unit 1. These efforts were primarily focused on the SFP and fuel storage building where significant improvements had been made in the condition of the facilities. Additionally, the licensee performed evaluations of the integrity of the concrete and the epoxy coating of the SFP to determine its acceptability for long term storage of spent fuel.

In the last five years, the licensee managed decommissioning activities through monthly meetings of an eight-member decommissioning project team, usually coordinated by the Unit 1 operating engineer. None of the members of the team or the Unit 1 operating engineer were assigned full-time to Unit 1 activities. Team members indicated that they typically spent from less than 10% to 50% of their time on Unit 1 activities. The operating engineer, a supervisor who reported directly to the operations department manager, had other significant duties associated with the operations staff for Units 2 and 3.

The inspectors interviewed two former Unit 1 operating engineers and the current engineer. From 1990 until April 1992, the operating engineer typically spent only about 15 to 20% of his time on Unit 1 duties. From April 1992 until December 1992, he estimated that he spent 50% of his time on Unit 1 activities. Since December 1992, additional operations staff duties were assigned, reducing the time spent on Unit 1 to about 10%. The Unit 1 operating engineer was generally acknowledged as being the person responsible for the material condition of Unit 1. The operating engineer during the time period from 1990 until April 1992 stated that he did not have immediate concerns about the adequacy of conditions at Unit 1. In fact, he was generally satisfied since the decommissioning team had accomplished significant improvements in the overall condition of the fuel storage building. He noted some concerns with conditions inside the containment from April 1992 until January 1994. These concerns were due to freezing of water in instrument air and containment heating equipment in 1992 and 1993, and leaking of water in the summer of 1993 in lines that were previously thought to have been isolated and drained. Because of these concerns, a contract was let for a study of system lay-ups which produced an initial draft report in February 1994.

The only other site employee with significant duties related to Unit 1 was the SAFSTOR project engineer, a non-supervisory employee in the Station Support group of Site Engineering and Construction. The inspectors interviewed the current and one former SAFSTOR project engineer. The current project engineer had several Dresden 2/3 projects to manage in addition to SAFSTOR duties. He estimated that the time he spent on Unit 1 had increased in the last 6 to 8 months to 70%. The former project engineer from 1987 to 1989 had significant additional assignments and estimated that she had spent only about 20% of her time on Unit 1.

The Unit 1 operating engineers and project engineers interviewed generally agreed that funding for Unit 1 projects was available in recent years. Workers, however, were not readily available. Unit 1 had to compete with the operating Units 2 and 3 for craft personnel and Units 2/3 had a large backlog of uncompleted work. Issuance of contracts for labor was also problematic since a bargaining agreement prevented contracting out for most types of work unless union workers had already been put on 48-hour work weeks. The people interviewed generally felt that labor availability was a principal reason why many of the Unit 1 projects seemed to take so long to complete.

9.2 Current Oversight

On February 11, 1994, the licensee announced the establishment of a new decommissioning Project Manager position for Unit 1. This supervisory level manager reported directly to the Station Manager. One of his first assignments was to determine the staffing level required to properly manage ongoing Unit 1 activities.

The inspectors evaluated the licensee's plans to increase staff and the level of attention focused on Unit 1. The plans appeared adequate. The effectiveness of the fully-established organization will be reviewed in a future inspection (IFI 50-010/94001-12(DRSS)).

9.3 Quality Verification Oversight

The quality assurance oversight program at the Dresden site was conducted, for the most part, at the site program level rather than at the Unit specific level. This was confirmed by the inspectors' review of reports documenting audits performed over the past several years. Few Unit 1 attributes were included in these audits and as a result, the auditing staff did not identify the significant decline in the material condition of the Unit or the disconnect between licensing documents and the physical configuration of the plant. The licensee confirmed that the Unit 1 quality verification oversight effort could have been improved.

The Unit 1 quality verification responsibility is assigned to a specific quality assurance auditor. This auditor also had a number of other collateral audit responsibilities. The licensee stated that it planned to reconfirm the quality verification expectations for Unit 1 with the cognizant auditor. Effectiveness of long-term actions to address Unit 1 quality verification weaknesses will be reviewed during future inspections (IFI 50-010/94001-13(DRSS)).

10.0 Licensee's Investigation of the Unit 1 Event

Shortly after the flooding incident, a high-level station investigation team was formed at the request of the Unit 1 operating engineer. This was soon upgraded to a 13-member multi-disciplinary investigation team composed of Dresden and corporate personnel and led by a previous Dresden Station Manager now working in the corporate office. The team's charter included a broad review of organizational control, material condition of Unit 1, and spent fuel storage and licensing status, including the Decommissioning Plan. The team was requested by the Site Vice President to:

- review events in a thoughtful and methodical manner,

- prepare a detailed description and analysis of the event,

- determine the root causes of the two events (removing the SFP filtration system from service and discontinuing heat in the containment),

- recommend specific or general actions to the Site Vice President,

- evaluate and recommend actions regarding:

  - Special Nuclear Materials,

  - Nuclear Safety,

  - SAFSTOR Decommissioning Plan, and

- prepare a briefing on status for the NRC inspection team.

The licensee's investigation team briefed the NRC inspectors on February 7, 1994, and assisted the inspectors in obtaining additional information throughout the inspection. On February 15, 1994, the team summarized its conclusions in an exit meeting with Station staff and NRC inspectors. A written report was provided to the Site Vice President on February 16, 1994, and contained 6 general and 11 specific recommendations. The major recommendations were:

- determine remedial measures and/or permanent heating and monitoring requirements to ensure integrity of the fuel transfer tube,

- consider organizational changes to focus appropriate attention on Unit 1,

- train licensed operators and others, as appropriate, on the significance of the Unit 1 event,

- upgrade training of Unit 2/3 licensed personnel to include detailed information on Unit 1,

- review Unit 1 licensing documentation to ensure that all other commitments are met,

- consider application of probabilistic risk analysis techniques to evaluate fuel storage at Unit 1, and

- expeditiously pursue storage options to allow removal of fuel from the fuel storage building.

The inspectors concluded that the team's findings and recommendations were very good and provided the plant with a strong framework to build an effective program to safely manage Unit 1 during the SAFSTOR period. However, the licensee's overall response to this event was mixed. Site and corporate management did not take an active role in assessing the magnitude of the event and the problems that resulted in the event. For example, few, if any, senior managers entered the containment or fuel storage building following the event to develop an appreciation for the seriousness of the problem and the decline in the material condition of the facility.

11.0 Licensee's Proposed Actions

Before the NRC Special Inspection Team concluded its inspection, the licensee announced a number of initiatives and planned activities that were directly or indirectly related to the containment flooding incident.

On February 11, 1994, the licensee established a new Unit 1 Project Manager position reporting directly to the Station Manager (Section 9.2).

The licensee also planned to remove loose contamination that resulted from flooding and backing up of drains inside the containment. This activity was scheduled in 6 to 8 weeks when the weather was warmer so that the water used for cleaning would not freeze.

The licensee also planned to improve the site weatherization procedures to ensure that extreme weather conditions were more properly addressed in the future.

In addition, the licensee was actively evaluating spent fuel storage options if conditions in the SFP continued to deteriorate. These options included (1) refurbishment and/or relining of the SFP, (2) transfer of the fuel to the GE Morris storage facility or to another licensee storage pool at another site, (3) transfer of the fuel to a Department of Energy monitored retrievable surface storage facility, or (4) onsite construction of a dry cask fuel storage facility for use by 1997.

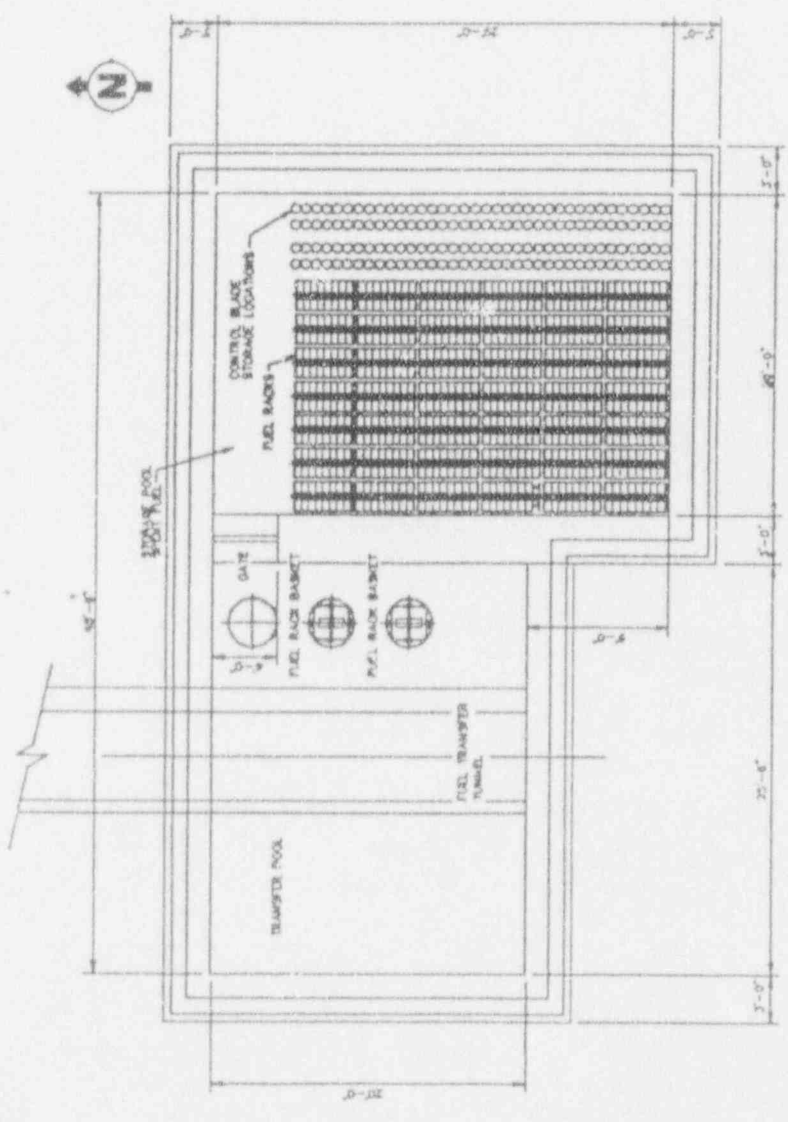
12.0 Exit Meeting

The NRC Special Inspection Team met with licensee representatives (denoted in Attachment 3) in an exit meeting on February 18, 1994, and summarized the purpose and findings of the inspection. No documents were identified as proprietary by the licensee.

ATTACHMENT 1

NOTE

REFERENCE



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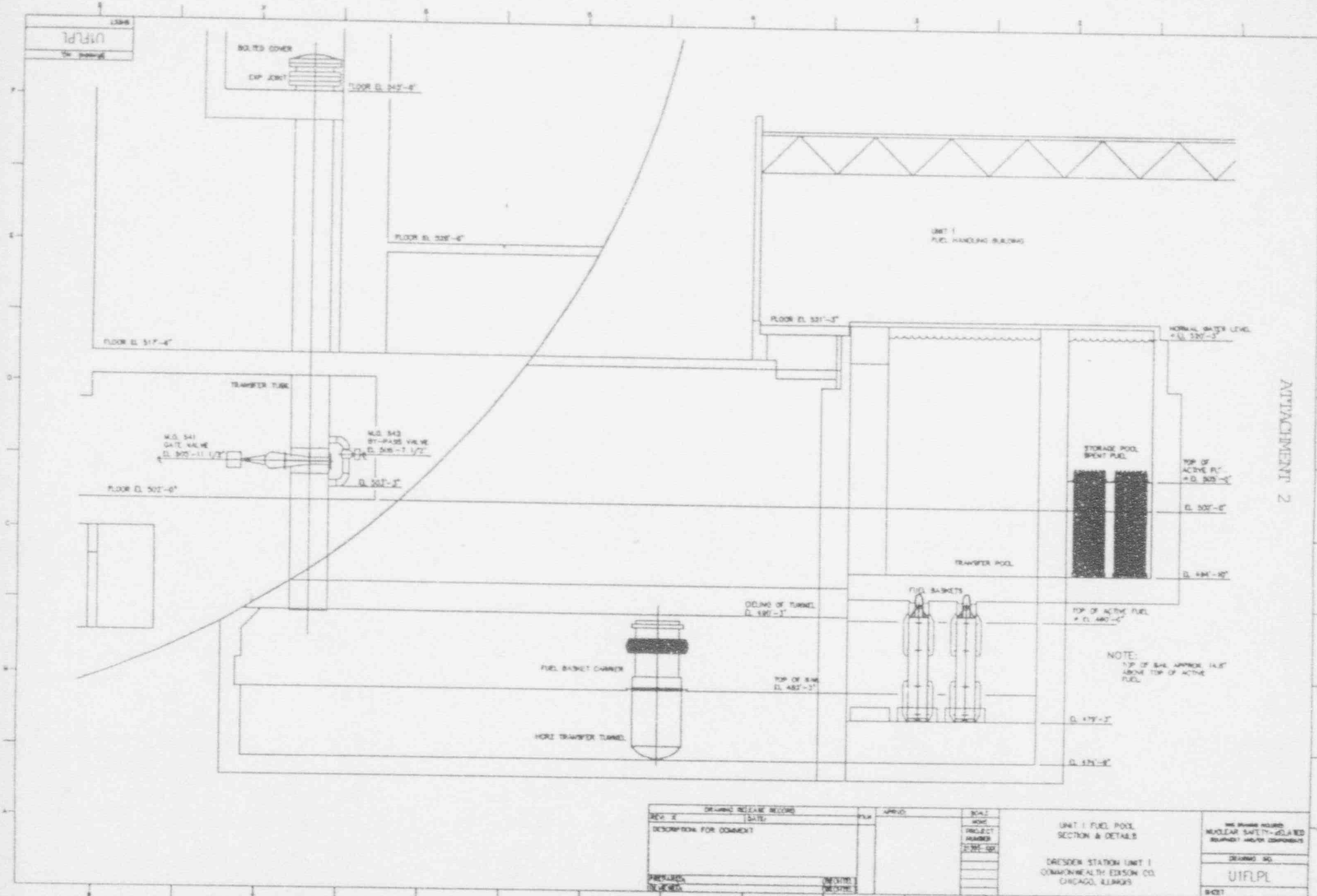
SHEET

ATTACHMENT 2



ATTACHMENT 3

EXIT MEETING ATTENDEES

Commonwealth Edison Company

E. Armstrong, Fuel Reliability Engineer
S. Koenig, Regulatory Assurance
B. Palagi, Dresden Unit 1 Manager
J. Shields, Regulatory Assurance Supervisor
L. DelGeorge, Vice-President, Nuclear Operations Support
T. O'Connor, Maintenance Superintendent
G. Spedl, Station Manager
R. Aker, Technical Services Superintendent
R. Flahive, Technical Services Superintendent
M. Korchynsky, Shift Operations Supervisor
D. Schavey, Operations Training Supervisor
D. Pritchard, Work Control Superintendent
N. Kauffman, Human Resources Supervisor
D. Elias, Senior Administrative Engineer
J. Kotowski, Operations Manager
L. Jordan, Health Physics Supervisor
R. Raguse, Health Physicist
W. Rakes, Radiation Protection Supervisor
E. Carroll, Chemistry Supervisor
J. Stremc, Unit 1 Chemist
H. Massin, Site Engineering and Construction Manager
R. Stachniak, Support Operating Engineer
B. Mayer, Generating Stations Emergency Plan Coordinator
M. Muth, Unit 1 Systems Engineer
H. Anagnostopoulus, Health Physics Specialist
T. Murphy, Unit 1/Radwaste Master Scheduler
J. Williams, Station Support Engineering Supervisor
D. Wheeler, Site Construction Superintendent
A. Feddersen, Unit 1 Project Engineer

Illinois Department of Nuclear Safety

C. Settles

U. S. Nuclear Regulatory Commission

J. Martin, Regional Administrator, Region III
C. Pederson, Chief, Reactor Support Programs Branch, Region III
J. McCormick-Barger, Team Leader and Chief, Radiological Programs Section 1, Region III
R. Dudley, Assistant Team Leader and Section Chief, Non-Power Reactors and Decommissioning Project Directorate (ONDB), Office of Nuclear Reactor Regulation (NRR)
M. Miller, Resident Inspector, Zion
T. Reidinger, Emergency Preparedness Analyst, Region III
P. Erickson, Senior Project Manager, ONDB
S. Brown, Project Manager, Nuclear Material Safety and Safeguards (NMSS)
A. Stone, Resident Inspector, Dresden
M. Leach, Senior Resident Inspector, Dresden
M. Kunowski, Senior Radiation Specialist, Region III
H. Ornstein, Reactor Operations Analysis Branch, Office for Analysis and Evaluation of Operational Data (AEOD)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
801 WARRENVILLE ROAD
LISLE, ILLINOIS 60532-4351

ATTACHMENT 4

FEB 4 1994

MEMORANDUM FOR: W. L. Axelson, Director, Division of Radiation Safety and Safeguards

THRU: C. D. Pederson, Chief, Reactor Support Programs Branch, Division of Radiation Safety and Safeguards

FROM: J. W. McCormick-Barger, Team Leader, Dresden Unit 1 Special Team Inspection

SUBJECT: DRESDEN UNIT 1 SPECIAL TEAM INSPECTION CHARTER FOR REVIEW OF THE JANUARY 24, 1994, SERVICE WATER SPILL TO CONTAINMENT

Attached is the inspection charter for the Dresden Unit 1 Special Team Inspection. This charter has been reviewed by the Offices of Nuclear Reactor Regulation, Nuclear Materials Safety and Safeguards, and the Division of Reactor Projects, Region III.

The objectives of this inspection will be to assess the current and past conditions at Dresden Unit 1 and the adequacy of our inspection and licensing program for the facility. The information obtained from this inspection will be communicated to regional and headquarters management along with any generic safety concerns and program recommendations. Documentation of the findings and conclusions of the onsite inspection will be issued in an inspection report.

If you have any questions regarding these objectives or the enclosed charter, please do not hesitate to contact me.

J. W. McCormick-Barger
J. W. McCormick-Barger
Team Leader

Attachment: As stated

See Attached Distribution

Distribution

cc w/attachment:
J. L. Milhoan, DEDR
H. L. Thompson, DEDS
E. L. Jordan, AEOD
T. E. Murley, NRR
S. Varga, NRR
J. W. Roe, NRR
J. A. Zwolinski, NRR
R. Bernero, NRR
B. K. Grimes, NRR
E. Rossi, NMSS
S. Brown, NMSS
S. H. Weiss, NRR
R. F. Dudley, NRR
A. E. Chaffee, NRR
W. M. Dean, NRR
P. B. Erickson, NRR
J. Lieberman, OE
J. R. Goldberg, OGC
J. B. Martin, RIII
H. J. Miller, RIII
E. G. Greenman, RIII
W. L. Forney, RIII
H. B. Clayton, RIII
P. Hiland, RIII
M. Leach, SRI, Dresden

DRESDEN 1 SPECIAL TEAM INSPECTION CHARTER

The Special Team Inspection will be comprised of team members representing NRR, NMSS, and Region III DRSS and DRP. Although this inspection will not focus on the identification of violations, it will include characterizing findings as enforcement items (violations), unresolved items, and open items. The team is to perform the inspection to accomplish the following:

1. Determine and validate the sequence of events associated with the pipe freeze/flooding event which occurred during the week of January 24, 1994.

2. Assess the current configuration of the fuel pool and fuel pool transfer system to ensure that the licensee has addressed design vulnerabilities that could result in loss of fuel pool water inventory following the removal of heat from the containment. This assessment should include a review of the licensee's actions concerning protecting the portion of the fuel transfer system located inside containment from freezing and the actions taken by the licensee to ensure that previous environmental conditions had not significantly damaged the system.

3. Review the licensee's leak detection and ground water monitoring system associated with the fuel pool for adequacy. Determine if it includes monitoring and trending fuel pool makeup in an effort to identify fuel pool leakage.

4. Evaluate the adequacy of the fuel pool gate seals.

5. Evaluate the consequences of and the potential for an inadvertent opening of the fuel pool transfer tube isolation and bypass valves and the acceptability of the existing valve power supply configurations.

6. Evaluate the potential for failures due to adverse temperatures or other failure mechanisms of major systems at Dresden 1 which could:

   (i) potentially result in significant offsite doses,

   (ii) potentially result in uncontrolled onsite or offsite release of radioactive material,

   (iii) adversely impact safe storage of Dresden 1 spent fuel,

   (iv) result in flooding and potential contamination from large amounts of water or other liquids,

   (v) result in significant occupational radiation dose hazards at the Dresden site, or

   (vi) potentially impact the safe operation of Dresden Units 2 and 3.

When potential failures are identified, ensure that adequate measures have been taken by the licensee to prevent the failures or to ensure that no unacceptable consequences may result.

7. Evaluate the root cause of the freezing/flooding incident and determine whether any licensee safety analyses performed before isolating heating steam to the containment building were adequate and in compliance with the existing plant license.

8. Evaluate the adequacy of the licensee's emergency preparedness plan and procedures to deal with reduction of fuel pool water levels (including access considerations which may be impacted by uncovery or near uncovery of the fuel).

9. Evaluate the current and historical adequacy of the licensee's oversight of the plant including the resources committed to maintaining the facility in a safe condition.

10. Review the licensee's initial evaluation of the radiological consequences of inadvertently draining the fuel pool as a result of a failure of the fuel transfer tube inside of containment. Determine the consequences of s[illegible] an event on the safe operation of Dresden units 2 and 3.

11. Verify the onsite inventory of all Dresden 1 spent fuel and verify that all fuel is safely stored.

12. Evaluate the accuracy and adequacy of the currently approved decommissioning plan and decommissioning technical specifications. Provide recommendations for changes as needed.

13. Evaluate the adequacy of the licensee's current and planned actions concerning the removal and disposition of spilled water in the containment and the subsequent cleanup of the facility, including the Unit 1 fuel storage building.

14. Determine the vulnerability of the leaking fuel assemblies and how this is encompassed in the SAFSTOR program.

15. Perform a generic "lessons learned" evaluation of this event to make initial recommendations regarding existing <u>inspection</u> practices and guidance for Part 50 reactor facilities undergoing decommissioning, both with and without spent fuel onsite.

16. Perform a generic "lessons learned" evaluation of this event to make initial recommendations regarding existing <u>licensing</u> practices and guidance for Part 50 reactor facilities undergoing decommissioning, both with and without spent fuel onsite.

Two-Year Trial Program for Conducting Open Enforcement Conferences; Policy Statement

AGENCY: Nuclear Regulatory Commission.

ACTION: Policy statement.

SUMMARY: The Nuclear Regulatory Commission (NRC) is issuing this policy statement on the implementation of a two-year trial program to allow selected enforcement conferences to be open to attendance by all members of the general public. This policy statement describes the two-year trial program and informs the public of how to get information on upcoming open enforcement conferences.

DATES: This trial program is effective on July 10, 1992, while comments on the program are being received. Submit comments on or before the completion of the trial program scheduled for July 11, 1992. Comments received after this date will be considered if it is practical to do so, but the Commission is able to assure consideration only for comments received on or before this date.

ADDRESSES: Send comments to: The Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, DC 20555, ATTN: Docketing and Service Branch.

Hand deliver comments to: One White Flint North, 11555 Rockville Pike, Rockville, MD between 7:45 a.m. to 4:15 p.m., Federal workdays.

Copies of comments may be examined at the NRC Public Document Room, 2120 L Street, NW. (Lower Level), Washington, DC

FOR FURTHER INFORMATION CONTACT: James Lieberman, Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555 (301-504-2741).

SUPPLEMENTARY INFORMATION:

Background

The NRC's current policy on enforcement conferences is addressed in Section V of the latest revision to the "General Statement of Policy and Procedure for Enforcement Actions," (Enforcement Policy) 10 CFR part 2, appendix C that was published on February 18, 1992 (57 FR 5791). The Enforcement Policy states that, "enforcement conferences will not normally be open to the public." However, the Commission has decided to implement a trial program to determine whether to maintain the current policy with regard to enforcement conferences or to adopt a new policy that would allow most enforcement conferences to be open to attendance by all members of the public.

Policy Statement

Position

The NRC is implementing a two-year trial program to allow public observation of selected enforcement conferences. The NRC will monitor the program and determine whether to establish a permanent policy for conducting open enforcement conferences based on an assessment of the following criteria:

(1) Whether the fact that the conference was open impacted the NRC's ability to conduct a meaningful conference and/or implement the NRC's enforcement program;

(2) Whether the open conference impacted the licensee's participation in the conference;

(3) Whether the NRC expended a significant amount of resources in making the conference public; and

(4) The extent of public interest in opening the enforcement conference.