U.S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No:	50-397/92-15
Docket No:	50-397
License No:	NPF-21
Licensee:	Washington Public Power Supply System P. O. Box 968 Richland, WA 99352
Facility Name:	Washington Nuclear Project No. 2 (WNP-2)
Inspection at:	WNP-2 site near Richland, Washington
Inspection Conducted:	April 13 through April 17, 1992
Inspector:	K. E. Johnston, Project Inspector

Approved by: P H Johnson — 5/18/92

P. H. Johnson, Chief — Date Signed
Reactor Projects Section 1

Summary:

Inspection on April 13 through 17, 1992 (Inspection Report No. 50-397/92-15)

Areas Inspected:

The purpose of the inspection was to assess the licensee's preparations for the full core off-load to the spent fuel pool and the reactor recirculation piping chemical decontamination, which were planned for the refueling outage beginning April 17, 1992. The inspector used inspection modules 60705, (Preparation for Refueling), 86700 (Spent Fuel Pool Activities) and Temporary Instruction TI 2515/113 (Reliable Decay Heat Removal During Outages) as guidance.

Safety Issues Management System (SIMS) Items: None.

Results:

General Conclusions and Specific Findings:

The licensee had made adequate preparations for the full core off-load and the chemical decontamination of the reactor recirculation system. The inspector identified some weakness in the contingency procedures for the full core off-load. The licensee took prompt action in correcting

the weaknesses and performed an engineering review which identified other procedural enhancements.

The inspector found that the shutdown safety technical assessment performed by the Nuclear Safety Engineering group was thorough and provided several recommendations to enhance outage safety. However, since it was issued less than three weeks prior to the April 17, 1992 outage, only a limited number of recommendations could be implemented for this outage.

Significant Safety Matters: None.

Summary of Violations and Deviations:

One non-cited violation was identified regarding the lack of a 10 CFR 50.59 design change review for a modification to the reactor building ventilation system as described in the Final Safety Analysis Report. (Paragraph 2.b)

Open Items Summary:

One non-cited violation was identified.

DETAILS

1. Persons Contacted

*J. Baker, Plant Manager
*L. Harrold, Assistant Plant Manager
*G. Sorensen, Manager, Regulatory Programs
D. Pisarcik, Health Physics and Chemistry Manager
*R. Webring, Plant Technical Manager
S. McKay, Operations Manager
S. Davison, Quality Assurance Manager
*A. Hosler, Licensing Manager
*J. Rhoads, Manager, OEAR/NSA
*J. Wyrick, Outage Manager
*S. Washington, Manager, Nuclear Safety Engineering
*M. Reis, Compliance Supervisor
*S. Scammon, Supervisor, Mechanical Systems, Plant Technical
T. Meade, Supervisor, Electrical Systems, Plant Technical
*N. Hancock, Shift Manager, Operations
*L. Morrison, Plant Chemistry Supervisor
*M. Eades, Licensing and Assurance
*S. Denison, Engineer, Quality Assurance
*D. Coleman, Engineer, Nuclear Safety Engineering
S. Flood, System Engineer, Plant Technical
M. Schmitz, System Engineer, Plant Technical

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*C. Sorensen, Senior Resident Inspector

The inspector also talked to other licensee employees during the course of the inspection.

*Attended the Exit Meeting on April 17, 1992.

2. Spent Fuel Pool Cooling

The inspector reviewed the licensee's preparations for placing all fuel in the spent fuel pool during the refueling outage scheduled to begin on April 17, 1992. To support this first-time full core offload, train B of the residual heat removal system (RHR) and its associated heat exchanger were aligned with the fuel pool cooling and cleanup system (FPCCS). The scope of the inspector's review included the following:

- pre-outage system testing
- operating, testing, and abnormal condition procedures
- Final Safety Analysis Report (FSAR) changes
- licensee engineering analyses
- the Nuclear Safety Engineering review of shutdown safety
- Quality Assurance oversight
  training and coordination
- emergency power preparation

In summary, the inspector found:

- While the engineering review appeared thorough, weakness was observed in the implementation of contingency planning into procedures and in the coordination and training necessary to ensure that Operations could respond to abnormal conditions.

- Preparations for emergency electrical power appeared thorough.

- The Nuclear Safety Engineering technical assessment of shutdown safety appeared thorough. However, since the assessment was completed less than one month prior to the start of the outage, the extent to which recommendations could be implemented for the outage was limited.

- A 10 CFR 50.59 design change review of a temporary modification to the reactor building ventilation which provides ventilation above the spent fuel pool was not performed.

In response to the first finding, the licensee conducted further review of their preparations and procedures. On April 22, 1992, the inspector conducted a conference call with the Plant Manager and members of his staff to discuss the licensee's findings. In summary, the Plant Manager concluded that while no major weaknesses were found, several enhancements to procedures and training were warranted.

System Description

The FPCCS consists of two independent pump and heat exchanger trains, and was designed to remove the decay heat of 12 cycles of spent fuel (approximately 8 million Btu/hr). The FPCCS pumps take suction from skimmer surge tanks which are gravity fed through an adjustable weir from the spent fuel pool.

The FPCCS was not designed to remove the decay heat of a complete core off-load. To facilitate a full core off-load, WNP-2 was designed with the capability of cross-connecting RHR train B and its associated heat exchanger with the FPCCS. The RHR suction from the FPCCS was provided between the skimmer surge tanks and the FPCCS pumps. The licensee had been operating with blind flanges installed and a spool piece removed. Prior to the outage, the spool piece was installed permanently, with blind flanges which can be removed when RHR assist is necessary.

Prior to this outage, the licensee had not conducted a complete core offload to the spent fuel pool and, with the exception of start-up testing, had not used the FPCCS with RHR assist. It was therefore necessary for the licensee to complete the following preparation for the outage:

- Revise the FSAR to clarify the use of the RHR assist to the FPCCS. To support the changes the licensee performed an engineering review.

- Install a spool piece between the RHR system and the FPCCS and modify a flow orifice to maintain RHR flow at approximately 3000 gpm.

- Perform testing of the FPCCS in the RHR assist mode.
- Develop operating procedures for FPCCS in the RHR assist mode.
- Develop and validate contingency procedures for loss of power and loss of cooling events.
- Review the consequences of boiling in the spent fuel pool on equipment in the reactor building and the ability to perform contingency procedures to recover fuel pool cooling.
- Review the outage schedule to ensure that equipment necessary to support FPCCS in the RHR assist mode and contingency plans was available.
- Perform a probability risk assessment of FPCCS in the RHR assist mode.

Findings

a. Implementation of FPCCS With RHR Assist

The inspector found the following weaknesses in the licensee's operating and contingency procedures:

- The operating procedures for FPCCS with RHR assist (PPM 2.8.5) required that the FPCCS flow instrumentation, which supplies control room indication, be isolated because if left in service it would be over-ranged by RHR flow. If RHR train B became unavailable, there would then be no fuel pool flow indication. The licensee's contingency procedure (PPM 4.8.5.1) did not require that FPCCS flow instrumentation be reestablished.
- When lined up to the spent fuel pool skimmer surge tanks, the RHR system did not have a loss of suction pump trip. The abnormal condition procedure (PPM 4.8.5.1) for low skimmer surge tank level did not require that the RHR pumps be tripped to prevent potential damage.
- The licensee had not evaluated whether, with the loss of RHR assist and one FPCCS pump, the use of two FPCCS heat exchangers was preferable to one.

During the exit meeting, the inspector presented these concerns. In addition, the inspector discussed the findings of the Nuclear Safety Engineering shutdown safety technical assessment, including a recommendation that training in the new procedures and contingency plans be enhanced. The inspector observed that while a considerable amount of review and preparations had been performed to support the full core offload, there appeared to be some weaknesses in implementation of the preparations into plant procedures and operator training.

In response, the licensee committed to conduct an independent system engineering review of the procedures and their implementation.

On April 22, 1992, the inspector conducted a conference call with the Plant Manager and members of his staff to discuss the licensee's review. The licensee had performed a fault tree analysis to establish the barriers which would prevent fuel pool boiling without inventory makeup. The licensee reviewed the barriers to establish whether they were adequately implemented. Twenty potential vulnerabilities were determined; some of these had previously been adequately addressed, while others required further enhancements. These enhancements included the following:

- To prevent inadvertent diversion of RHR flow while in the FPCCS assist mode, all other potential RHR flow paths would be isolated by closed, tagged, and de-energized valves.

- Although four of the five crews had been through RHR assist testing at full power, new and revised procedures were reviewed by all crews, with the Shift Manager conducting on-shift training.

- The maintenance request specifying the steps necessary to establish temporary power to buses SL-81 and -83 was upgraded to a formal procedure, requiring formal validation and review.

In addition, the licensee addressed the inspector's concerns regarding flow instrumentation, RHR pump cavitation protection, and heat exchanger priorities by revising appropriate procedures.

The Plant Manager concluded that while the review did not find significant weaknesses, the review and resulting procedure improvements, training, and coordination enhancements provided confidence in the licensee's plans to perform a full core offload.

b. Engineering Review

To support the RHR assist of FPCCS during a full core offload, the licensee performed the following engineering analyses:

- A calculation of fuel pool temperature rise was performed assuming various alignments. It was determined that optimum cooling was provided with the RHR heat exchanger available. With only the two FPCCS trains operating, the pool temperature could be maintained below 170 degrees F. With less than two trains operating, the spent fuel pool could reach boiling.

- A review of RHR and FPCCS net positive suction head was performed. This determined that with boiling in the spent fuel pool, a minimum level in the skimmer surge tanks would provide adequate suction head for the RHR pump to be started.

- A probabilistic risk assessment was performed to confirm that necessary equipment was available.

- A review was performed of the effects of spent fuel pool boiling on reactor building equipment and the ability of operators to respond to reestablish spent fuel pool cooling.

The inspector found that these engineering reviews had been performed acceptably. However, the inspector did identify one instance where the appropriate engineering review had not been performed.

During a walkdown of the refueling floor with the FPCCS operating in the RHR assist mode, the inspect observed that the ventilation exhaust ducting which normally takes suction above the spent fuel was taped over. The exhaust ducting was taped to prevent spent fuel pool water from entering the ventilation system in the event the water level increased to the height of the ducting (several inches above normal pool level).

The taping of the exhaust ducting was done in accordance with Temporary Procedure 8.3.227 TP, "RHR Assist Mode of Fuel Pool Cooling Test." In addition to taping the ventilation ducts, the procedure required that ventilation damper REA-AD-3, the reactor building ventilation damper which isolated the spent fuel ducts, be closed.

The inspector reviewed the FSAR regarding the reactor building ventilation system (section 9.4.2). The FSAR described that one of the design basis functions of the reactor building ventilation system was to draw air across the surface of the spent fuel pool by exhausting around their perimeters, to control temperature and to maintain airborne radioactivity within acceptable limits. Although the FSAR identified this as a design function, this was not a safety related function of the reactor building ventilation system.

The inspector asked if the taping of the ducts had been considered as a modification to the facility as described in the FSAR, requiring a 10 CFR 50.59 evaluation. The licensee determined that while a 50.59 evaluation had been performed to cover several aspects of the temporary procedure, a specific evaluation had not been performed for isolating ventilation flow from the spent fuel pool.

On April 15, 1992, the license initiated Problem Evaluation Request (PER) 292-307 to address whether the appropriate review had been performed. The licensee's review determined that steps in PPM 8.3.227 TP had been based on the reactor building ventilation procedure PPM 2.10.1. PPM 2.10.1 had allowed the latitude to close ventilation duct REA-AD-3. It was determined that the latitude to isolate REA-AD-3 had not received appropriate 10 CFR 50.59 review. It was also determined that the taping of the ducting had been performed under a maintenance work request with REA-AD-3 closed and under a clearance tag, and with the exception of insufficient independent verification on removal, was performed appropriately.

Due to the limited safety significance and the licensee's prompt evaluation, and because the criteria specified in Section VII.B(1)

of the Enforcement Policy were satisfied, this was considered a non-cited violation (92-15-01, Closed). It was also noted that shortly after the inspector questioned this aspect, a QA engineer asked the same question.

c. Provisions for Emergency Power

The inspector reviewed the licensee's provision for emergency power. The licensee determined that while the core was offloaded, the worst case single failure would be the loss of the safety related 4KV bus (SM-8) which supplies power to the RHR train "B" pump and the FPCCS train "B".

To mitigate the consequences of the loss of SM-8, the licensee developed plans for a temporary power supply to the 480V buses which supply the loads necessary for FPCCS train "B" to remove heat.

The contingency plans were to provide power from non-safety related 480V bus SL-11 to the necessary safety related 480V busses, SL-81 and SL-83. Prior to completing the core off-load, a temporary modification would provide a 600 amp cable routed from the back of a breaker cubicle in SL-11, through several walls and doors, to the back of a breaker cubicle in SL-81. Cable would be routed from an adjacent breaker cubicle in SL-81 to SL-83.

To accomplish the cross-tie in the event that SM-8 was rendered inoperable, the following would be necessary:

- With SM-8 de-energized, all loads on SL-81 and SL-83 would have to be stripped.
- Spare breakers would be moved to the appropriate cubicles in SL-11, SL-81, and SL-83, racked in and closed to energize SL-81 and SL-83.
- The necessary loads would be sequenced onto SL-81 and SL-83.

At the time of the inspection, the licensee was drafting a maintenance work request which would govern the temporary modifications and the breaker alignment. Although the concept was simple, the following complexities were addressed.

- Steps were necessary to ensure that during the bus loading process, the rating of the cable was not exceeded. This required monitoring of bus amps and controlling of battery charging rate.
- The loads necessary to provide an operable FPCCS system, including auxiliary loads, had to be identified.
- A step was required for an electrician to lift leads on a relay to remove an SM-8 undervoltage relay input to an SL-81 motor control center.

Subsequent to the inspection, the licensee drafted an abnormal condition procedure which accomplished the above. The procedure was validated by plant operators who performed a step by step walk-through. It was determined that the emergency lineup would take between three and four hours. The most time-consuming task was the stripping and loading of the buses.

The licensee had considered performing a functional test of the emergency power source. However, it was concluded to be impractical and unnecessary based on the following:

- To perform a functional test, it would be necessary to de-energize SM-8 for the duration of the functional test, making RHR "B" unavailable for decay heat removal.
- In previous outages, the licensee has used a temporary power cable to energize necessary loads while its supplying bus was out of service.
- The licensee developed confidence in the contingency procedure through the validation process.

The inspector found the licensee's contingency plans for temporary power to be acceptable.

d. Shutdown Safety Assessment

The inspector reviewed a shutdown safety assessment, completed by the licensee's Nuclear Safety Assessment organization on March 31, 1992. The assessment provided a review of WNP-2 outage planning using NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management."

The assessment covered the following areas:

- outage planning and control, including integrated management, contingency planning, training and outage safety review;
- decay heat removal capability;
- reactor coolant inventory control;
- power availability; and
- reactivity control.

While the assessment did not find significant weaknesses in the licensee's approach to shutdown safety, it did find that much of the control was informal. The assessment identify several recommendations to ensure that shutdown safety was maintained. Some of the recommendations were suggested for implementation prior to the April 17, 1992 refueling outage. Other recommendations were to be implemented prior to the 1993 refueling outage.

The inspector reviewed the assessment and found it to be thorough and insightful. At the exit meeting, the inspector observed that some of recommendations which had been suggested for the outage had not been fully implemented due to late issuance of the assessment. Had the review been more timely, some of the recommendations could have been better implemented.

One non-cited violation was noted, as discussed in Paragraph 2.b.

3. Chemical Decontamination

The inspector reviewed the licensee's preparation for the chemical decontamination of reactor recirculation piping, focusing on the mechanical aspects of the project.

The chemical decontamination of the recirculation piping was the first such effort at WNP-2. The licensee planned to use the LOMI (low oxidation state metal ion) chemical process to decontaminate the recirculation piping from the recirculation pump suction valves to six feet below the jet pump rams' heads.

To accomplish chemical decontamination, a chemical solution is injected from a vendor-supplied skid into one recirculation loop between the pump and its closed suction valve. The solution is then brought to a predetermined level in the recirculation piping and allowed to sit for a specified time. Then the solution is pumped from the first recirculation loop into an equivalent setup in the second recirculation loop. After repeating this evolution several times, the chemical solution, now burdened with radioactive corrosion products, is processed through vendor-supplied demineralizers. Finally, the demineralizer resins are slurried to a disposal liner.

The inspector performed the following to assess the licensee's preparations for the chemical decontamination:

- review of the licensee's governing procedure (PPM 10.2.89) and the vendor procedures it referenced
- interview of the system engineer and a tour of the laydown area
- interview of the QA manager regarding QA coverage
- review of the licensee's assessment of the compatibility of the LOMI process with recirculation piping

The inspector found the licensee to have taken adequate preparation in the following areas:

- The lead system engineer had observed a recent chemical decontamination at an other facility and had incorporated lessons learned.
- Recirculation piping and welds between the recirculation pump suction valves and the pump discharge were found to be compatible with the chemicals used in the decontamination process.

- Reactor vessel level and recirculation loop levels were identified as critical parameters to prevent LOMI chemicals from reaching the reactor vessel.

- QA was performing a surveillance of preparations for and implementation of the process. Specific items of interest were identified, such as recirculation piping level measurement, quality verification of the chemical to be used, and verification of the equipment lineup.

- The license had planned full-time supervision of the vendor during the decontamination process by the engineers involved in the preparation.

- A static head pressure test of approximately twice operating pressure was proceduralized.

- The procedure included precautions to prevent chemicals from entering other systems through leaking valves, and required post-decontamination flushes of the RHR and reactor water cleanup systems.

No findings were identified. The inspector observed at the exit meeting that QA had initiated its evaluation relatively late in the preparation process, which could limit its effectiveness. The licensee concurred that the evaluation had received a late start, but stated that all findings would be given due consideration.

4. Exit Meeting

An exit meeting was conducted with the indicated personnel (refer to paragraph 1) on April 17, 1992. The scope of the inspection and the inspector's findings, as noted in this report, were discussed with and acknowledged by the licensee representatives. In addition, the inspector conducted a conference call with the Plant Manager and members of his staff on April 22, 1992 to discuss further information described in paragraph 2.a of this report.

The licensee did not identify as proprietary any of the information reviewed by or discussed with the inspector during the inspection.