Florida Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302

March 28, 1994
3F0394-13

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Response to Additional Information Request Concerning Reactor Coolant Pump Oil Collection System Exemption Request

Reference: A. FPC to NRC letter, 3F0693-04, dated June 7, 1993
B. NRC to FPC letter, 3N0993-22, dated September 10, 1993

Dear Sir:

Florida Power Corporation requested an exemption to the oil collection system requirements of Section III.O to 10 CFR 50, Appendix R, Reference A. The Commission's review of this submittal resulted in a request for additional information in order for the staff to complete the Safety Evaluation, Reference B. The attachment to this letter provides FPC's response to this request.

Sincerely,

P. M. Beard, Jr.
Senior Vice President
Nuclear Operations

PMB
attachment

xc: Regional Administrator, Region II
NRR Project Manager
Senior Resident Inspector

040024

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Attachment

Additional Information
Concerning Oil Collection System
Exemption Request

Request 1. In order to properly assess the safety impact of a fire involving the oil associated with one of the Reactor Coolant Pump (RCP) motors, please describe the consequences of a postulated oil fire involving the leak sites under worst case leak conditions. Discuss what effects this would have on the integrity of the reactor coolant system (RCS) piping and pump seals.

Response 1. The effects of a fire originating from any of the postulated leak sites would have little, if any, impact on the integrity of the RCS piping and pump seals. If a fire were to start it would likely be as a result of contact with hot RCS surfaces. This would happen quickly upon contact and would not allow for an accumulation of a significant amount of oil to be available for combustion. Only the trail or film of oil from the leakage site would be available to support the fire. The geometry of the fuel sources to the ignition sources is such that the leak source sites are all above the RCS pump seals and the bulk of the RCS piping. The fire would propagate upward and away from the reactor coolant pumps. Film oil fires would quickly diminish in size and be of short duration. This is because the size of the fire is a function of its surface area and as the fire burns the surface area of the fuel film is quickly decreased. A steady state is reached at or near the leak site with the fire consuming the fuel at the leak rate until the fuel source is exhausted. Furthermore, radiative and convective heat transfer would be very low for the target surfaces because they would be attenuated by atmospheric absorption due to the large volume of the Reactor Building and high relative humidity. Due to the fact that the RCS piping and RCP seals are designed to operate at high temperatures, the effects of a small oil film fire on their overall integrity is thought to be negligible.

In addition, CR-3's Fire Hazards Analysis has analyzed a fire in the area of the reactor coolant pumps which resulted from the ignition of the total contents of the RCP lube oil system. The resulting postulated fire did not adversely affects the plant's ability to safely shutdown. Therefore, the consequences of a fire which might result from any spillage or leakage of RCP lube oil would not pose a significant risk to the safe operation of the plant.

Request 2. If an RCP motor oil fire were to occur, please explain how the plant and the fire protection features provided for the area of concern would respond to this condition. For example, explain how the fire would be detected; what actions would be taken by plant operations; and how the fire would be controlled and extinguished. Are the cubicles accessible for manual fire fighting?

Response 2. Fire Detection: If an RCP motor oil fire were to occur, any one of an array of three fixed temperature heat detectors with 190 degree Fahrenheit setpoints located over each RCP would initiate an alarm. Two detectors from this array comprise the Zone 23 fire alarm circuit. One detector from this array comprises the Zone 24 fire alarm circuit. Each is a Supervised Class "A" circuit which alarm both on the local fire panel adjacent to the Reactor Building (RB) personnel hatch in the Intermediate Building and on the main fire alarm panel in the Control Room.

Plant Operations Actions: If a fire signal were to be initiated by one of the fire zones, the Control Room operators would investigate the alarm and confirm a fire by looking for other alarms indicating RCP trouble such as low oil level/pressure alarms, or high vibration. If any of these conditions occurred in conjunction with the fire alarm or a second fire zone went into alarm, an entry into the RB to investigate and fight the fire would be initiated. If alarm or operating conditions were indeterminate, the Control Room would confirm products of combustion present in the RB atmosphere.

Fire Fighting: The fire brigade would make an entry into the RB to investigate and fight the fire. The RB standpipe system would be charged and the fire brigade would initiate a fire attack in accordance with the Crystal River Unit 3 Pre-fire Plans using fire extinguishers and hoses connected to the nearest internal standpipe hose connections. Six hose connections are located at different levels of the RB.

RCP cubicle Accessibility: The RCP cubicles are accessible for manual fire fighting. The four RCP's are located in two separate areas designated as "D" rings (because of the shape) inside the RB. Two RCP's are located in each of the "D" rings. The "D" rings are semi-circles approximately 28 feet in diameter and 85 feet high, and are accessible from both the top and the bottom with stairs, ladders and platforms constructed throughout the interior of the cubicle. The RCP motors are located approximately 45 feet above the floor. The fire brigade can attack fires from two different directions using either of two stair towers with access either above or below the pump motors.

Request 3. If a leak were to develop from one of the potential oil leak sites not covered by the RCP oil collection system, could oil leak on any hot RCS piping or lagging surfaces? If there is a possibility of oil leakage contacting hot RCS piping or lagging, have these surfaces been shielded to direct potential oil leakage to a safe location?

Response 3. As described in Reference A, four areas of the RCP motor oil collection system are proposed to not be equipped with leakage protection. These areas are the Anti-Rotation Device (ARD) Vents (2 vents with mechanical connections and demisters), the ARD upper oil supply lines from the lift oil pump (lines with mechanical connections from the low pressure oil pump), the lower RCP motor leak detection system piping (mechanical connections), and the lower guide bearing and oil temperature thermocouples (mechanical connections). A discussion of each is provided below.

ARD Vents and ARD Upper Lube Oil Supply Lines (2 each): The ARD vents are located at the top of the RCP motor and are equipped with demisters. The low pressure lube oil supply lines for the ARD are also located at or near the top of the RCP motor on the outside surface. These vents and lines are seismically designed to withstand the Safe Shutdown Earthquake. The vents provide venting for the ARD torque drum, an enclosure for the ARD alignment bearing, and extend above the torque drum. The upper lube oil supply lines provide a small amount of lube oil to the ARD torque drum via the low pressure oil supply system. The lube oil supplied is returned internally to the upper RCP lube oil reservoir.

These vents are not a part of a pressurized system and are rarely disassembled. The joints for these vents are socket welded with the exception of the connections at the ARD torque drum and the joint at the demister. The demisters are designed with a filter to prevent lube oil mist from escaping to the outside environment. Although no specific collection system is established for leakage from the demisters or vent mechanical connections, if leakage were to occur, the oil would run down the side of the torque drum and bearing housing and would be collected by a one inch lip located on the bottom of the upper RCP motor bearing housing, and channeled to the oil collection drain pan for the upper lube oil cooler. This in turn would drain to the RCP lube oil collection system tanks. Therefore, leakage from the ARD vents would not contact the hot RCS pumps, piping, or lagging.

The upper lube oil supply lines connect the low pressure RCP lube oil lift pump and the low pressure upper RCP motor bearing lube oil pump to the ARD oil supply lines within the torque drum. This system is seismically designed and is made up of tubing with mechanical joints to allow maintenance of the upper sections of the RCP motor. Leakage due to seepage, runoff or spray could occur since this is a low pressure oil system. Lube oil seepage, runoff and a portion of spray would be contained by the one inch lip on the upper motor bearing housing described above. This leakage would be channeled to the oil collection system tanks and would not come in contact with hot RCS surfaces. Lube oil spray from mechanical connection leaks that is not captured by the one inch lip could potentially run down the RCP motor onto hot RCS surfaces. No shielding is provided to protect the RCS pumps or piping. However, this type of leakage is not expected as a result of the tubing fitting design, post maintenance visual leakage inspections and the seismic design of the lines.

Lower RCP Motor Leak Detection System: The function of the lower RCP motor leak detection system is to provide cooling water leak detection for leakage from the RCP motor air to water heat exchanger. The joints for the leak detection system are socket welded with the exception of the threaded union connections for each union nut connection installed within the leak detection piping, the threaded connections for the level alarm system, and the threaded connections at the lower RCP motor housing. These connections are threaded for maintenance purposes.

The RCP motor leak detection system would not normally contain lube oil. The lower lube oil reservoir would require overfilling well beyond the normal oil fill level, or leakage at the lower RCP motor bearing, or significant bearing failure would have to occur for the leakage detection system to contain a significant amount of lube oil. If a significant amount of lube oil were to accumulate in the leak detection system, an alarm would result which would require immediate action by operations personnel. If significant lube oil were to collect in the leak detection system and the threaded connections discussed above were to leak, lube oil could seep or runoff onto hot RCS surfaces. No shielding is provided to protect the RCS pumps and piping. This type of leakage is not expected due to post-maintenance inspections of the connections and the seismic design of the system.

Lower Guide Bearing and Oil Temperature Thermocouples (2): The lower guide bearing and oil temperature thermocouples are located near the lower RCP motor bearing housing and extend to just outside the edge of the RCP motor casing. Each of these instruments have two mechanical connections, one at the RCP motor lower bearing oil reservoir housing, and the other at their outer end for insertion of the thermocouples into the thermocouple pipe. The inner most threaded connections are directly over the RCP motor lower drain pan. Leakage from these inner connections would be conveyed to the oil collection system tanks. The outer most threaded connections are the sites which would not be covered by the oil collection system. These thermocouple connections are seismically designed and are located in a non-pressurized system. Leakage as a result of seepage or runoff from the outer connections could potentially contact hot RCS surfaces. Oil spray as a result of connection leakage is not possible since they are located in a non-pressurized system. No shielding is provided to protect the RCS pumps and piping. Leakage from these sites is not expected due to controlled installation processes and post-maintenance inspections.

Request 4. In order to quantify the magnitude of the fire problem, what is the quantity of oil contained in each RCP and what are the flammability characteristics of the oil (eg., flash point, ignition temperature, heat release rate)? In addition, please provide a description of the RCP cubical, including approximate floor areas, volumetric dimensions, and air flow rates through the cubical.

Response 4. Quantity of Oil in Each RCP: Each RCP motor has two lubrication systems. The upper system contains approximately 175 gallons of oil, and the lower system contains approximately 15 gallons. The combined lube oil systems for each RCP, therefore, contains approximately 190 gallons of oil.

RCP Lube Oil Characteristics: There are three types of lubricating oil recommended for use in the RCP's.

Gulfcrest 32 (Gulf Oil)
Turbinol T 68 (British Petroleum)
Teressic 68 (Exxon)

The following flammability characteristics data was taken from Material Safety Data Sheets, NFPA 325M, and the Handbook of Fire Protection Engineering.

Flashpoint and Method:	218^0 C (425^0 F) using P-M method
Auto Ignition Temperature:	500^0 - 700^0 F
Stoichometric Air Fuel Ratio:	2300 cf of air to 1 cf of oil
Burn Rate:	4 mm/minute in open pool
Heat Release:	18,686 BTU/lb

RCP Cubicle Description: The four RCP's are located in the RB in two separate areas designated as "D" rings with two RCP's located in each of the rings. The "D" rings are semi-circles approximately 28 feet in diameter and 85 feet high which are open at the top and partially open on the bottom. The RCP motors are located approximately 45 feet above the floor. The approximate floor area of each "D" ring is 1230 square feet. The approximate volumetric area of each "D" ring is 104,624 cubic feet (40% to 50% of this volume is occupied by equipment). The air flow through the "D" rings is by convective force only. There is no installed forced air ventilation system.