Omaha Public Power District
444 South 16th Street Mall
Omaha NE 68102-2247

February 7, 1997
LIC-97-015

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, DC 20555

Reference: 1. Docket No. 50-285
2. Letter to OPPD (S. K. Gambhir) from NRC (J. E. Dyer) dated January 17, 1997.

Subject: Response to Questions Related to 10 CFR Part 50, Appendix R as proposed in NRC Inspection Report 50-285/96-16.

This letter forwards Omaha Public Power District's (OPPD's) responses to the questions proposed in Reference 2 concerning the Reactor Coolant Pump (RCP) lube oil collection system. Included as attachments are copies of relevant documents. This letter summarizes the licensing and design bases of the RCP lube oil collection system, evaluates equivalency of the new ABB RCP motor and discusses the internal oil leak on RCP-3D motor.

Based on OPPD's review, the current lube oil collection system will ensure safe shutdown in accordance with 10CFR50, Appendix R, consistent with the SER clarifications and approved exemptions noted in the attachments. However, we recognize that the leakage in RCP-3D is not in strict compliance with Appendix R, and should be repaired or reduced as much as practical. Short term actions have been implemented to clean up and minimize the leakage. RCP-3D is presently operating with a reduced, oil level which has resulted in effectively stopping the oil leakage. Procedural guidance is currently in place to address operation of RCP-3D with a reduced oil level. Long term corrective actions are to eliminate the leakage problem in RCP-3D and plan for a modification that will collect oil from the major leak points.

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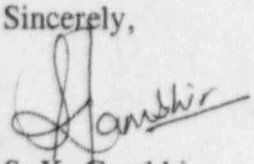
Drawing Available in Central Files

If you should have any questions, please feel free to contact me or my staff.

Sincerely,



S. K. Gambhir
Division Manager
Production Engineering

DDD/ddd

Attachments: 1) OPPD Fire Protection Program Submittal, LIC-76-0180, dated 12/31/76
2) Program SER, LIC-78-0104, dated 8/23/78, appropriate pages
3) RCP Lube Oil Design Package, NRC Submittal, LIC-79-0059, dated 6/6/79
4) Safety Evaluation by the Office of Nuclear Reactor Regulation Supporting Amendment No. 53 to Facility Operating License No. DPR-40 OPPD FCS, Unit No. 1 Docket no. 50-285
5) NRC Triennial Inspection Report, LIC-88-880, dated 9/23/88
6) OPPD Exemption Request, LIC-88-1066, dated 11/28/88
7) NRC Exemption to Appendix R, III.O, LIC88-457, dated 12/20/88
8) 10 CFR 50, Appendix R, Section III.O White Paper Review, dated August 9, 1996
9) Task Assignment Form, CID No. 960584/01, dated 12/13/96
10) Operability Evaluation Form, NOD-QP-31, for CR No. 1996001624, dated 1/14/97
11) Trend Chart for Reactor Coolant Pump Levels
12) OI-RC-9, Operating Instruction Reactor Coolant Pump Operation, Revision 30, issued 01-28-97
13) RCP Motor P&ID

c: Winston and Strawn
L. J. Callan, NRC Regional Administrator, Region IV
L. R. Wharton, NRC Project Manager
W. C. Walker, NRC Senior Resident Inspector
T. P Gwynn, NRC Director, Division of Reactor Safety

NRC Question 1.

"Provide a comprehensive discussion of how Omaha Public Power District meets the fire protection requirements of Appendix R as it relates to lube oil collection systems on the reactor coolant pumps. This discussion should describe the previous and current plant configuration and detail the scope and basis of any regulatory exemptions that have been granted."

OPPD Response

Detailed Review of Design and Licensing Basis for Lube Oil Collection System.

The following discussion details the docketed correspondence history which provides the previous and current plant configuration, details the scope and design basis of the RCP motor lube oil collection system, and states OPPD's position on the compliance issue of 10 CFR Part 50, Appendix R.

RCP motor lube oil collection requirements date back to the NRC's Fire Protection (FP) Guidelines of Appendix A to **APCSB 9.5-1 (1976)**. OPPD's original FP program submittal (Attachment 1, dated 12/31/76) acknowledged RCP lube oil as a "major combustible." The submittal evaluated a 15 minute fire burn in containment resulting from combustion of the total lube oil inventory from one RCP motor (150 gallons was used for the appraisal). The evaluation concluded that a burn of this magnitude spread throughout a steam generator bay would not prevent safe shutdown of the plant. This evaluation was referenced by OPPD as meeting the Appendix A, "Control of Combustibles," mandate [per section D.2(a)] without a RCP motor lube oil collection system.

The Safety Evaluation Report (SER) (Attachment 2, dated 8/23/78) granted to OPPD in response to the above submittal lists the **RCP Lube Oil Collection System as an incomplete item**. The SER states that OPPD committed to respond to the incomplete item by June 1979.

OPPD submitted a Final Design Package of MR-78-057, "RC Pump Lube Oil Collection," (Attachment 3, dated 6/6/79) to the NRC for review and approval prior to construction. The purpose of the lube oil collection system proposed per this modification was "to collect and contain RCP lubricating oil leaks in order to reduce the probability of a lube oil fire in the containment building." The modification package submittal documented the design basis of the lube oil collection system, including the information that the lower oil reservoir was not provided with an oil collection system. A key passage (Attachment 3, page 4) in this submittal is as follows:

> *The lower oil reservoir is not being collected since it contains only four (4) gallons, has an internal oil cooler and there are no pressurized lines, sight glasses, etc. Also, the oil level*

transmitter is not contained since the transmitter housing has a pressure rating of 500 psig and it is only exposed to 17 inches of oil.

NRC documented acceptance of the proposed configuration in Amendment 53 (Attachment 4, dated 11/17/80) to the Fort Calhoun Station (FCS) Operating License. The SER for Amendment 53 states:

The staff has reviewed this information and find that our concern has been satisfactorily addressed. We consider this issue to be closed.

OPPD would like to clarify that the 17 inch level, stated in Attachment 3, as quoted above, was in error. The actual level, or static head, is 5 inches. (The change is not significant since it was in the conservative direction.)

The RCP lube oil collection system was subsequently reviewed by the NRC in 1988 during a triennial FP inspection. The results of this inspection (Attachment 5, dated 9/23/88) listed the oil collection system as an unresolved item. The following was taken from Section 4.c of attachment 5 in its entirety.

The NRC inspectors reviewed the design of the reactor coolant pump oil collection system. The design appeared adequate with the exception of the capacity of the oil collection tanks. Section III.O of Appendix R requires that oil leakage be collected and drained to a vented closed container that can hold the entire lube oil system inventory. The licensee's design is for two collection tanks with a capacity of 150 gallons each. Each of the four reactor coolant pumps has an oil capacity of 115 gallons. Thus, there is a total tank capacity of 300 gallons to collect a total oil supply of approximately 460 gallons. However, according to the FCS fire hazard analysis the largest oil leak has been determined to be less than 80 gallons total.

Since the oil collection system, including collection pans, drain lines, and collection tanks has enough capacity to hold all of the oil from the pumps, there appears not to be a safety concern. However, the present system does not comply with Section III.O of Appendix R and an exemption is required. ***This will be considered an unresolved item pending the licensee's submittal and NRR's review and acceptance of the exemption request for the reactor coolant pump oil collection system.*** *(285/8828-03)*

No violations or deviations were identified.

OPPD would like to make a clarification to the last sentence in the first paragraph quoted. The Fire Hazards Analysis does not state the largest leak to be 80 gallons total. The exemption submittal, LIC-88-1066, assumed a "Maximum Expected Leak" of 110 gallons; where as, the 1976 program submittal is based on 150 gallons.

OPPD filed an exemption request to 10CFR50 Appendix R III.O (Attachment 6, dated 11/28/88) with the NRC. The exemption was requested for Fire Area 30 from the requirements that the lube oil collection system drain tank capacity be capable of holding the entire lube oil system inventory of the RCPs. The capacity of the drain tank is based on a maximum single failure (Upper Oil Reservoir) leak rather than the full lube oil inventory of two RCP motors (two RCPs drain to each tank). The exemption request also responded to **three questions raised during a phone conversation** held between D. Kubicki of NRR and OPPD staff on 11/25/88. The three questions and answers are as follows:

Question 1
NRR was told by a Regional Inspector that the entire system tanks, piping etc. when taken as an entity would contain the total inventory of all four pumps. Is this a true statement? Please provide an explanation.

Answer
The total volume of one collection pan and its associated piping is approximately 120 gallons (110 gallon pan capacity + capacity of approximately 50 feet of nonshared 2 inch drain piping of 10 gallons). This gives a total two pump system capacity of approximately 390 gallons (120 gallons + 120 gallons + 150 gallon tank). However, there is no mechanism installed that would prevent the entire volume of oil collected from draining into the collection tank and out of the overflow. Therefore, 130 gallons of oil could potentially flow out of the overflow for the worst case oil loss scenario.

Question 2

The system was seismically designed:

a. *Does this mean that the piping will not fail? or*
b. *Is the piping designed to 2 over 1 criteria so that it can fail but not fall? If so, can we state that where ever the line fails, that the oil leakage will not contact a potential ignition source.*

Answer

The system was designed with flexible couplings to prevent the piping from leaking due to motion. The piping design criteria was to survive a SSE with its leak integrity intact. In the event the piping were to leak, the potential ignition sources in the area consist of reactor coolant system components with surface temperatures above 500 °F. The scenario of a reactor cavity lube oil fire has been shown to have no adverse effects on safe shutdown.

Question 3
OPPD states that the system will contain oil from pressurized points. What about unpressurized points?

Answer
The oil piping that is unpressurized is either internal to the motor bearing assembly or of such a high pressure rating that oil leakage is not considered a credible event. The total volume of the unpressurized oil system in the lower bearing assembly is only four gallons per pump. The entire upper bearing assembly is provided with collection capacity with the exception of the level transmitters which are rated at 500 psig.

The NRC subsequently approved this exemption (Attachment 7, dated 12/20/88); section 3.0 of the SER states:

The staff was also concerned that all unpressurized leakage points were not encompassed by the oil collection system. The licensee indicated that oil piping that is unpressurized is either internal to the reactor coolant pump (RCP) motor bearing assembly or qualified to withstand the elevated pressures anticipated during a seismic event.

As noted in an OPPD White Paper (Attachment 8, dated 8/9/96) this wording appears to be in error as a result of combining statements from question 2 and 3 above, and needs to be corrected. However, it is clear that the NRC did approve OPPD's design that does not collect oil from piping that is unpressurized, including the lower bearing assembly.

In review, the design and licensing basis for the lube oil collection system is summarized below:

RCP motor lube oil license basis (various correspondence since 1978)

1. The RCP Oil Collection System installed per MR-78-057 was reviewed and approved by the NRC.
2. The NRC Appendix R audit report categorized the FCS RCP oil collection system capacity deviations as "not safety significant" but suggested that an exemption from the Appendix 'R' requirement was required. This was the only open item.
3. Containment has been analyzed for a 150 gallon lube oil fire in the RCP/Steam Generator Cavity and found not to impact safe shutdown capability of the station.

RCP motor lube oil design basis (per submitted modification package MR-FC-78-057)

1. Pressurized components and the (upper) reservoir are totally enclosed in "leak resistant" pans.
2. The lower bearing reservoir does not require collection due to no credible leak points external to the motor.
3. 110 gallons is the worst case single RCP motor lube oil failure (which is well within the 150 gallon fire hazards analysis assumption).

The NRC approved OPPD's exemption request to 10CFR50, Appendix R III.O

1. An exemption on the capacity of the drain tank, based on a maximum single failure (Upper Oil Reservoir) leak rather than the full lube oil inventory of RCP motors, was approved.
2. The oil collection system design that does not collect oil from piping that is unpressurized, including the lower bearing assembly was approved.

Recent Motor Replacement:

During the 1996 Refueling Outage, OPPD replaced the RC-3B GE motor with an ABB motor of the same size. The motor was manufactured by ABB Industrial in Switzerland. The new motor lube oil collection system is designed to be equivalent to the existing GE motor lube oil collection system.

Prior to the 1996 refueling outage OPPD performed a fire protection interaction review for MR-95-022, RCP Motor Replacement for RC-3B. This review concluded that certain information relative to the 1988 exemption should be updated. This was discussed with the NRC/NRR Project Manager in late August 1996. He agreed that, following the 1996 Refueling Outage, OPPD should update appropriate descriptions of the RCP lube oil system previously provided to the NRC in support of the 1988 exemption, and propose corrections/updates to the exemption SER. The requested submittal was to include the 50.59 evaluation addressing fire protection aspects of the motor replacement, and a summary of the assessment showing that the lube oil capacity of the new RCP-3B pump motor will not place OPPD outside the bounds of the previous fire hazard analysis. This information is included in the answer to question 2 below and contained in more detail in Attachment 9.

Oil Leakage from RCP-3D Motor:

An internal oil leak has developed on RCP-3D motor. It occurs following an oil fill of the upper oil reservoir. Oil is apparently being carried over the top of the internal stand pipe in the upper reservoir by rotation of the motor thrust runner and then flows down along the motor shaft. As the oil level drops (less than 1/2") the leakage stops. Since this leakage path was not expected or anticipated in the original oil collection design, the current design is not in strict compliance with Appendix R. It is OPPD's view that this leak path should be repaired, or reduced as much as practical. A more complete description of the leakage path and the actions (short and long term) are provided by the response to question 3.

NRC Question 2.

"The white paper indicates that Omaha Public Power District has recently modified Reactor Coolant Pump B, which has resulted in a physical configuration of the lube oil system that is different from the other pumps. Provide a description of the new configuration of the lube oil system for Reactor Coolant Pump B and how Omaha Public Power District has addressed the differences as they relate to the applicability of the exemption request in LIC-88-1066."

OPPD Response

A detailed description of the new RCP-3B motor, built by ABB Industrial, and a comparison with the other three RCPs is included in Section 2 of Attachment 9. The differences, as they pertain to the exemption request in LIC-88-1066, were addressed in Section 3, Fire Protection Evaluation, of Attachment 9.

Comparing the fire hazard of the new pump motor to the old reveals that (1) the new RCP motor configuration is within the postulated design basis fire burn time submitted to and approved by the NRC, and (2) the baseline RCP Fire Hazard Analysis per the original FP program submittal (Ref. Fire Protection Program Submittal LIC-76-0180) is still valid since the postulated fire duration of the new motor configuration is less than originally evaluated. The data used in original analysis is based on 150 gallon RCP lube oil inventory. The new pump contains a nominal 82.4 gallons which includes 11.6 gallons for the lower oil reservoir. Therefore the fire loading is less than before.

The lube oil collection system is similar in design to the old system as indicated in the following tables:

UPPER OIL RESERVOIR

NEW ABB MOTOR	OLD GE MOTOR	COMPARISON
The oil lift pump, piping, oil level indicator, fill/drain, and oil level transmitter piping external to the motor are enclosed in two collection enclosures. The oil collection enclosures are connected to the existing oil drain system. The side and upper panels are not oil tight, but, they are designed and constructed to contain leaks from pressurized oil lines and drain to the oil collection system. The oil level indicator, fill and drain, and oil level transmitter piping are only subject to the pressure head of the oil level in the reservoir. The oil enclosure panels are made of 0.079" thick stainless steel panels and are designed to maintain structural integrity during a design basis earthquake.	The oil lift pump, piping, oil level indicator, fill/drain, and oil level transmitter piping external to the motor are enclosed in three collection enclosures and are drained to retention tanks. The top enclosures are not leak tight, but, they are designed and constructed so that oil spray will be contained. The enclosure panels are made of 0.06" thick stainless steel panels and are designed to maintain structural integrity during a design basis earthquake.	The new motor upper lube oil system is simpler in design and has less piping and joints that could potentially leak outside the motor housing. The new motor upper lube oil collection system is designed to maintain structural integrity during a design basis earthquake. Each enclosure has a 1.75" diameter drain tied to a 2" existing lube oil drain system. The existing lube oil system is a closed system consisting of piping, flexible hose and a vented collection tank. A taller standpipe in the upper lube oil reservoir adjacent to the thrust runner reduces the potential for the type of leakage assumed to be occurring in RCP-3D.

LOWER OIL RESERVOIR

NEW ABB MOTOR	OLD GE MOTOR	COMPARISON
The lower bearing lube oil reservoir has a fill/drain. oil level indicator, vent, and oil level transmitter external to the motor housing. The fill/drain and level indicator are inter-connected and can be considered a single unit. The lube oil reservoir has a 11.6 gallon capacity. Oil piping and instruments external to the motor are not provided with a collection/drain system based on the following; 1.)Oil piping is un-pressurized (no pumps). 2.)The oil fill and drain is made from carbon steel bar stock and has three 1" diameter "Bull's Eyes" for oil level indication. Each "Bull's Eye" is rated at 256° F @23 psi. The fill/drain and level indicator unit is attached to the motor housing by four 12 mm or 0.47" diameter bolts. 3.)The Rosemount oil level transmitter has a pressure limit of 2000 psig. 4.)The oil level indicator and transmitter are designed to maintain structural integrity during a design basis earthquake.	The lower bearing oil reservoir has the same basic components such as the fill/drain, level indicator, and oil level transmitter. The lower reservoir is inside the motor housing and requires 4 gallons of oil. The oil level indicator does not have "Bull's Eyes" as with the new motor. The oil level is checked by opening the level indicator top cover. The Foxboro oil level transmitter has a pressure rating of 500 psig.	The new and existing motor oil cooler, oil piping and instruments are basically the same. The new motor oil level indicator has three 1" diameter "Bull's Eyes" for oil level reading (See pictures in Attachment 9). The "Bull's Eyes" have no load bearing surfaces. The new motor oil level indicator unit is conservatively designed in terms of construction and mounting. Based on the design and construction of the lower lube oil reservoir, it is concluded that the probability of an oil leak is remote for both the new and existing motor.

Summary of Answer to Question 2:

1. The existing licensing basis for a safe shutdown fire in containment is not challenged by the new RCP motor modification. FCS maintains the ability to be safely shutdown in the event of a design basis fi

2. The new pump motor lube oil system as evaluated in Attachment 9 does not present an additional fire hazard.

3. The 10 CFR 50.59 safety evaluation determined that this modification did not involve an unreviewed safety question and the existing licensing basis for Safe Shutdown Fire in Containment is not challenged.

4. The standpipe in the ABB motor, being taller than those in the GE motors, will have less potential for the type of leakage assumed to be occuring in RCP-3D.

NRC Question 3.

"Describe the compensatory measures that Omaha Public Power District has taken (or plans to take) to prevent any further lube oil leakage from the upper bearing of Reactor Coolant Pump D. In addition, provide a detailed description of the present fire hazard that exists in this pump due to the previous uncollected lube oil leakage."

OPPD Response

An internal oil leak on RCP-3D motor was first identified in June of 1995. The oil leakage from RCP-3D is caused by an internal migration of non-pressurized oil from the upper oil reservoir. Oil is apparently being carried over the top of the internal stand pipe in the upper reservoir by the rotation of the motor thrust runner. The standpipe is designed to keep upper reservoir oil from running down the motor shaft (see drawing, Attachment 13). The normal running oil level in FCS's motors is very close to the top of the standpipe because of the as-designed bearing configuration. Apparently, in the RCP-3D motor, the rotation of the thrust runner causes a small quantity of oil, over several weeks, to be pushed over the top of the standpipe and down the motor shaft. As the oil level drops (less than 1/2") the leakage slows and then stops. Once over the standpipe, the oil drips to an area above the rotor shaft air seal. This oil then drips out of several air outlet ports and drains located on the outside of this part of the motor. This leak path is outside of the oil collection system.

Since the end of the refueling outage in November 1996, the motor has lost an estimated 2 to 3 gallons of oil. The majority of this leakage occurred within the first few weeks of operation of the pump motor. When the level dropped to the lower end of its operating range, the leak rate slowed or stopped. Currently, RC-3D is operating with very minimal leakage (see trend charts provided in Attachment 11). The leakage results in some oil on internal motor components and on the walkways and floors directly beneath the motor. During the plant startup the oil was observed to be dripping out of the air outlet ports and drains from the internal portions of the motor above the rotor shaft air seal.

An operability evaluation (Attachment 10) was performed for the oil leakage from the motor of RCP-3D into the pump bay. The impact of oil leakage on the internals of the motor, hot insulated RCS components, and uninsulated or exposed blanket insulated RCS components was evaluated. This evaluation determined that the amount of currently uncollected oil plus any minor unanticipated leakage of oil that is uncollected during the cycle, are not a significant fire hazard and are well within the assumptions of the previous fire hazards analysis. OPPD recognizes that oil leakage outside of the motor oil collection system, although within design basis, is undesirable (for details please see Attachment 10).

The existence of an internal to external unpressurized oil leakage path in RCP-3D is not a

condition that was explicitly anticipated in the original design of the lube oil collection system. Thus, while the current lube oil collection system will ensure safe shutdown in accordance with 10CFR50, Appendix R, consistent with the SER clarifications and approved exemptions noted in the attachments, **the leakage in RCP-3D is not in strict compliance with Appendix R, and will be repaired or reduced as much as practical.** As discussed in Attachment 10, RCP-3D and piping under and around the RCP-3D motor has a metal jacket over the insulation, so that oil soaking of this insulation from unpressurized leaks is minimized. The operability evaluation provided in Attachment 10 provides the mitigating measures OPPD has instituted to reduce the leakage.

Short term compensatory actions include:

1. operation at reduced oil level in the upper reservoir,

   Special instructions and specific actions (OI-RC-9, Attachment 12, dated 1/28/97) have been proceduralized for RCP-3D to monitor motor bearing temperatures, vibration, refilling the reservoir, and notification of the system engineer if an alarm or abnormal condition is indicated for the motor. OI-RC-9 was revised to include instructions from an Operations Memorandum which was issued earlier.

2. minimizing the amount of oil added during the operating cycle,

   The system engineer makes recommendations to maintenance personnel on how much oil should be added, based upon the upper oil reservoir leakage trend data, in order to provide adequate lubrication of the motor and minimize oil leakage.

3. clean-up and removal of oil as plant conditions permit, and

4. monitoring total oil usage to ensure only a minor fraction of the analyzed 150 gallon limit is allowed.

Long term actions:

1. RCP-3D motor will be replaced with the motor removed from RC-3B which is now being refurbished (unless emergent problems with another RCP motor require priority use of our one spare). If the motor is not replaced, the modification described in action 2 below will be completed on RCP-3D during the 1998 refueling outage. Repair of the leakage will be attempted when the RCP-3D motor is sent out for general refurbishment, currently scheduled for the 1998 refueling outage.

2. OPPD will evaluate the physical orientation, and configuration necessary for installation of a modification which would collect oil from the internal leakage path. The modification would be designed, to the extent practical, to route leaking oil to

the collection system to minimize the potential for oil accumulation around the pump bay. Installation of the oil collection modification for the GE motors, if feasible, will be during the 1999 refueling outage.

3. Further, a study evaluating the leakage from RCP-3A, C, and D GE motors will be initiated in 1997. This study will evaluate alternatives to the modification of the oil collection system described in action 2 above, i.e. eleminating the source of leakage.

In Summary:

- While the current lube oil collection system will ensure safe shutdown in accordance with 10CFR50, Appendix R, consistent with the SER clarifications and approved exemptions noted in the attachments, the leakage in RCP-3D is not in strict compliance with Appendix R, and will be repaired or reduced as much as practical.

- Short term actions have been implemented to minimize leakage. As of February 6, 1997, the motor appears to be running with very minimal leakage.

- Long term correction is planned to eliminate the leakage problem and enhance the collection system by adding piping for collecting oil from major leak points.

ORIGINAL FP SUBMITTAL

LIC-76-0180

DOCKET NO. 50-285

FIRE PROTECTION PROGRAM REVIEW

FORT CALHOUN

UNIT I

OMAHA PUBLIC POWER DISTRICT

December 31, 1976

1976 SUBMITTAL

5.2.2 Control of Combustibles

Buildings and structures containing components and systems important to safety are of reinforced concrete construction. This type construction has the advantages of noncombustibility of construction materials, and also of a high degree of resistance to the effects of fires which might occur from other sources.

As shown in Table 5.2.1 and Figures 5.2.1 through 5.2.8, the safety-related areas of the plant are divided into a large number of compartmen or rooms, and most equipment is housed in one of these. The walls and floors between compartments or rooms are also solid reinforced concrete construction. Their thicknesses are determined by a number of factors including radiation shielding. All but one are adequate to qualify them as fire barriers of three-hour or greater rating. Doors and electrical cable penetrations have also been evaluated. Door ratings have been compared to the contained fire load. Where ratings are inadequate, three-hour rated doors will be installed so that all doors, as a minimum, will have a rating in excess of the contained fire load. At locations where electrical cables in trays penetrate a wall, floor, or ceiling, the opening will be sealed to maintain barrier integrity against fire spread, as described in Section 6.0.

Major combustibles in the plant are associated with the turbine generator (hydrogen and oil), the feedwater pumps (oil), electrical transformers (oil), the emergency diesel generators (fuel), the diesel fire pump (fuel), the plant auxiliary boiler (fuel), the charcoal filters (charcoal), the reactor coolant pumps (oil), and the charging pumps (oil). Small amounts of oil are associated with other pumps and components. Of the above listed

The plant auxiliary boiler is located in the basement of the service building, east of the turbine building. It is separated from the auxiliary building and containment by the intervening turbine building. Its fuel is stored underground.

The four reactor coolant pumps are located in two compartments in the containment along with other reactor coolant loop components. They are isolated from other components by the compartment walls.

Thus, the overall plant layout provides for isolation of the major combustibles described above from safety-related components and systems. The layout additionally provides for separation of equipment in the auxiliary building. Separate fire areas are provided for the various systems and components as shown in Figures 5.2.1 through 5.2.8.

5.2.3 Electrical Cable, Cable Trays and Penetrations

Particular attention was given during the plant design and construction phase to minimizing the combustibility of electrical cables. Cable insulation systems were specified, tested and evaluated to ensure a high degree of fire resistance as well as meet other safety requirements. Table 5.2.2 describes the cable insulation systems used in Fort Calhoun Unit 1. Cables have been certified by the manufacturer to be capable of passing the fire-resistance test requirements of IEEE-383. Cables were subjected to a qualification test program which included the

different sections of the yard loop so that isolation of any one section will not disable both the primary and backup fire protection systems.

As shown on the flow diagram, Figure 5.3.10, a connection has been provided to flush and fill the fire water system with treated water. Maintenance procedures require that, after draining, the system be filled with treated water.

To provide additional fire-fighting capability in the auxiliary building, manual hose stations will be provided throughout. Number, location and equipment to be provided will be in accordance with BTP 9.5-1, based on the fire hazards analysis. Potential locations are shown on Figures 5.3.11 through 5.3.14. Standpipes serving these hose stations will be connected to an auxiliary building fire water header fed from each end by connections to the yard loop.

Halon extinguishing systems to protect the electrical switchgear room and the cable spreading room will be installed to provide an additional measure of protection for these areas. The systems will be designed and installed in accord with the requirements of NFPA and BTP 9.5-1.

Numerous portable extinguishers are located throughout the plant. Their type and location are shown on Figures 5.3.10 through 5.3.18.

Fire protection for the containment interior has been evaluated, taking into account the factors of type and location of combustible materials, potential effects of fires in containment, accessibility of various areas of containment during operation and during outages, and potential effects of misoperation of extinguishing systems if installed.

Major combustibles include reactor coolant pump motor lube oil, charcoal filters and cable insulation. Shielding and thermal

insulation materials are noncombustible. Additional combustibles (plastics, paper, etc.) are brought in only for refueling and maintenance.

The two reactor coolant pumps, the steam generator and the piping associated with each reactor coolant loop are contained within a reinforced concrete compartment. Fire detectors are provided at each pump to detect a lube oil fire. The fire hazards analysis for this area, given in Section 5.5, shows that combustion of the total amount of lubrication oil from a reactor coolant pump would result in a fire severity of less than 15 minutes. Detection of a lube oil fire would allow the pump and its oil system to be shut down, possibly stopping the discharge of oil and lessening the severity of the fire.

The pressure boundary of the reactor coolant system is heavily insulated. A fire of 15 minute severity would have no effect. The support structures and members for the reactor coolant loop components consist of massive members which, although unprotected from fire exposure, would also have a fire resistance rating to withstand a fire of this severity. Electrical cables, instruments and other light components in the area might be damaged by such a fire, but would not jeopardize safe shutdown.

The need for a fire extinguishing system in this area has been evaluated, and such a system is not considered necessary. In addition to the considerations discussed above, problems associated with a sprinkler or deluge system were also considered. Failure or inadvertant operation of a water system would represent a potential source of chlorides and other impurities which could initiate or promote corrosive attack of the reactor coolant system pressure boundary. Additionally, unborated water available in containment would represent a potential boron diluent in the

event of a loss of coolant accident.

Cable fires in containment have also been considered, and are discussed in the fire hazards analysis Section 5.5. Cable insulation has been tested and shown to be fire resistant, even in the configuration in which it is installed in trays. If a cable fire is postulated to occur in containment, the numerous detectors installed would give early warning to allow manual fire-fighting measures to be taken. Because cable fires are slow burning (one to two inches per minute), time exists for an orderly shutdown and bringing in fire hose from outside, if necessary. Because of the redundancy and separation provided for the limited amount of safe shutdown equipment in containment, safe shutdown would be possible in the event of a postulated cable fire.

Charcoal filters in containment are equipped with spray systems which receive borated water from the containment spray system. In the event of a loss-of-coolant accident, the spray system will be initiated, if required, to prevent ignition of the charcoal by adsorbed fission products.

FT. CALHOUN STATION UNIT I

SECTION 5.5

FIRE SAFETY EVALUATION

Fire Area 30

Containment

4860 ft² per ground level (3)

Controlled Access
Safety Related

Area Description

The containment structure is located in the center of the auxiliary building. It is bordered on the east by the electrical penetration area, on the west by the HVAC equipment and fuel handling area and on the north by the mechanical and pipe penetration areas and the HVAC equipment and fuel handling area. All walls separating this area from the other mentioned areas are 3-hr fire rated barriers.

The containment consists of three floors, basement (989'), ground (1013'), and operating (1045'). These are connected by two unenclosed stairwells. The reactor, two steam generators, pressurizer and four primary coolant pumps are enclosed in concrete cells running vertically through all three floors. There are four safety related divisions of cables in the containment. These are routed so that they meet the separation criteria as a minimum. Much of the cabling is enclosed in conduit.

Safety Related Systems and Components

A) Safety Injection System
- Safety Injection Tank SI-6A
- Safety Injection Tank SI-6B
- Safety Injection Tank SI-6C
- Safety Injection Tank SI-6D
- Safety Injection Control Panel AI-136-A,B,C,D,
- Low Pressure Safety Injection control Panel AI-140, A,B,C,D

B) Chemical and Volume Control System
-- Regenerative Heat Exchanger CH-6

C) Containment HVAC system
- Containment Air Cooling and Filtering Unit VA-15A
- Containment Air Cooling and Filtering Unit VA-15B
- Detector well Air Cooling Unit VA-13A
- Detector well Air Cooling Unit vA-13B

D) Component Cooling System
- Component Cooling Water Cooling Control Panel AI-138, A,B,C,D
- Component Cooling Lube Oil Cooling control Panel AI-139 A,B,C,D

Postulated Fire

As a result of the large volume in the containment which is divided into three floors with several cell-like compartments, it is more informative to postulate three fires and examine the potential consequences of each.

Postulated Fire A: (Location Basement level) The lubrication oil for one of the primary coolant pumps is assumed to ignite as a result of a leak in the lubrication system. The location is on the basement elevation within the concrete cell that encloses two primary coolant pumps and a steam generator. The burning of 150 gal of oil in this space is equivalent to a 15 minute fire.

Postulated Fire B: (Location Ground level) A cable tray fire is assumed to occur in a cable tray at section 20c on the ground level. This location is selected because of the number of cable trays at this location.

Postulated Fire C: (Location Operating level) A fire is postulated in the central rack of filters (one half the total) located in containment ventilation equipment VA-6A and VA-6B. This is equivalent to a 7 minute fire.

Consequences of Fire Without Active Protection

Postulated Fi. There are flame sensitive fire detector units monitoring each reactor coolant pump. Any significant combustion would also be detected by the ionization detectors in the containment. Early warning could allow the operator time to accomplish an orderly reactor shutdown and to trip off that pumps lubrication system which may serve to eliminate the source of the burning oil. The insulation on the primary coolant boundary would protect it from the maximum fire severity that could be expected in this concrete cell. The massive structural hangers of the primary coolant system would not be affected by a fire of this severity. This fire could not propogate to any of the cable trays on the basement level. The instrumentation cables attached to the primary coolant pipes near the pump are enclosed in conduit. Interruption of these cables would not prevent safe shutdown.

Postulated Fire B: All cable runs in the containment meet the separation criteria. Since the only significant combustibles on this level are the cables a fire was postulated at a high density region of cable trays along the eastern perimeter of the containment structure. Assuming total involvement of

the six cable trays (two of which are separated by 3 ft from the other four). The maximum consequences would be the loss of several safety related division D cables. This would not prevent safe shutdown since redundant divisions A,B and C are available.

Postulated Fire C: The primary source of combustibles on the operating level are the charcoal filters. The postulated fire may spread from the initial location to a maximum of one-half the total filters. The filter fire in itself would cause no damage to safety related equipment, other than the ventilation system. A charcoal fire is relatively isolated by the structure of the filter assembly. These are dampers, mist extractors, and absolute filters in front of the charcoal filters. After the filters there is a long section of ventilation ducting leading to the ventilation fans. These features can be expected to contain the charcoal fire in the filter assembly. A deluge system which receives containment spray water is installed in these filters. The deluge system is manually initiated.

No safety related cable trays are at this evaluation. This postulated fire would not prevent safe shutdown, nor cause radioactivity release outside the containment.

Consequences of Fire With Active Protection

Postulated fire A: Fire suppression is manual.
Postulated fire B: Fire suppression is manual.
Postulated fire C: Fire suppression is manual except in event of DBA when the charcoal filter deluge system is automatic.

The automatic fire protection system will provide prompt alarm of a fire in this area. The plant fire brigade has ample portable fire extinguishers to quickly extinguish a local fire.

Combustible Material	Quantity	Fire Load	Maximum Fire Severity
Basement Level - Steam Generator Cell A			
Lubricating Oil	~~300~~ 600 gals	~~36,600~~ 8900 Btu/ft^2	~~28 Min~~
Basement Level - Steam Generator Cell B			16 Min.
~~Lubricating Oil~~	~~300 gals~~	~~36,600 Btu/ft^2~~	~~28 Min.~~
~~Basement Level~~			
Cable Insulation	9290 lbs	~~16,880~~ 12,320 Btu/ft^2	~~13 Min.~~
Ground Level			
Cable Insulation	13,500 lbs	24,523 Btu/ft^2	19 Min.
Operating Level			
Cable Insulation	1,000 lbs	1200 Btu/ft^2	
Charcoal Filters	11,500 lbs	16,000 Btu/ft^2	13 Min.

Fire Protection

The fire detection system in containment includes thirty-three ionization type detectors; thirteen on the ground level, seventeen on the intermediate level and three on the operating floor. There are four flame type detectors on the intermediate level and eight air duct detectors; six on the operating level and two on the basement level. All detectors provide alarm and annunciation locally as well as in the control room.

There are five 10 lb dry chemical extinguishers located in containment. Four of these extinguishers are on the operating level (El. 1036'-0") at column's (5b,N), (3a,N), (5b,Q) and (3a,Q). The fifth is on the basement level (El. 994'-0") at column (2c,N). There are also five 20 lb dry chemical extinguishers and two 15 lb CO_2 extinguishers in containment. Three of the dry chemical extinguishers are on the ground floor (El. 1013'-0") at columns (4a,N), (5b,N) and (2b,)P. Two others are on the basement floor (El. 994'-0") at (2a,Q) and (5b,Q) near the reactor coolant pumps and the CO_2 extinguishers are located on the intermediate level (El. 1022'-0") at (2b,L), and (5b,L). A high temperature deluge system also exists for the charcoal HVAC filters.

2. Control of Combustibles

a. Isolation and Separation of Combustibles

Isolation and separation of combustibles are discussed under Section 5.2 above, as related to fuel oil and lube oil systems, cable insulation, etc. This requirement is met.

b. Bulk Gas Storage

Bulk hydrogen is stored out-of-doors, away from safety-related equipment. Hydrogen and nonflammable gases are required in certain areas for operation of hydrogen analyzers or other equipment. These gases are stored in minimal amounts and the cylinders are properly secured.

c. Plastic Materials

Plastic materials use has been minimized, except for use of cable insulation and jackets. Cables have been specified and tested to be fire retardant. To provide an extra degree of assurance that they will not be a fire hazard, flame retardant coatings will be applied to cables in the most important locations. Fire detection and extinguishing capability are provided in areas of maximum cable concentration. Therefore, it is concluded that the intent of this criterion is met.

d. Storage of Flammable Liquids

Storage of flammable liquids complies with the requirements of NFPA 30, "Flammable and Combustible Liquids Code."

of appropriate NFPA standards. Particular consideration will be given to the topics listed for design of the systems. The criteria will be met.

5. Carbon Dioxide Suppression Systems

No fixed carbon dioxide suppression systems are installed or planned. The criterion is not applicable.

6. Portable Extinguishers

Fire extinguishers are provided in accordance with NFPA 10-1975. Where the dry chemical type was selected, consideration was given to adverse effects on equipment and on cleanup problems.

D. Guidelines for Specific Plant Areas

1. Primary and Secondary Containment

Fire hazards in the containment have been identified and discussed in this report (Section 5.3.2 and Section 5.5). These include reactor coolant pump lube oil, cable insulation, and charcoal filters. The containment fire detection system, described in Section 5.3.1, includes both general area detection and fire detection for specific locations. The analysis, as well as industry experience with circulating water pump lube oil fires, indicates that automatic extinguishment of these fires is not required to provide protection of the health and safety of the public. Sprays are installed in the charcoal filters in containment using containment spray water in the event of a loss-of-coolant accident and later ignition of the charcoal by heat from deposited fission products. Manual extinguishment is used for other fires if they occur in containment. The intent of the criterion is met.

3.2 Incomplete Items

The licensee has committed to take action on incomplete items as noted below. The staff's review of the licensee's response to these items and any further proposed changes to the fire protection program will be addressed in a supplement to this report. The schedule for the completion of the licensee action on these incomplete items is given in Table 3.2. The sections of this report which discuss these items are noted in parentheses.

3.2.1 Rupture of Fire Water Piping (4.3.1.3)

The licensee will analyze the effects of rupture of the fire water piping, to be installed, on safety-related equipment.

3.2.2 Testing Fire Detectors (4.2)

The licensee has agreed to provide the bases and criteria for the installation and testing of fire detectors.

3.2.3 Reactor Coolant Pump Lube Oil Collection System (5.20)

The licensee has agreed to provide one of the following:

(1) A lube oil collection system to contain lube oil leakage and to drain leaked oil to a safe place.

(2) A fire suppression system to control a lube oil fire and to protect the reactor components from that fire.

(3) A study for NRC consideration which includes, a detailed evaluation of the installation of the lube oil collection system and the lube oil fire suppression system, and a detailed analysis that shows the facility can be safely shutdown in the event of a unmitigated lube oil fire. The unmitigated fire analysis will consider, but is not limited to, localized effects of the fire, effects on containment filters and other combustibles in the containment, as well as pressure and temperature effects throughout the containment building.

3.2.4 Cable Separation (4.10)

In all areas where both divisions of cables in systems required for safe shutdown are routed in the same fire area, the licensee will describe the minimum separation between redundant cables, including interposing combustibles. Additional modifications will be accomplished as necessary to preserve safe shutdown capability.

2

5/23/75 SER

TABLE 3.2

3.2 Licensee Submittal Dates for Incomplete Items.

3.2.1	Rupture of Fire Water Piping	June 1979
3.2.2	Testing Fire Detectors	In Progress for Existing Detectors
3.2.3	Reactor Coolant Pump Lube Oil Collection System	June 1979 Analysis, June 1980 Modification if Needed
3.2.4	Cable Separation (Completion of Analysis)	September 1978

fire in this area. Backup is available by circulating raw water in the component cooling system.

19.4 Fire Protection Systems

Fire detection is provided by ionization type smoke detectors, three of which are installed in the area and four of which are installed in ventilation ducts serving the area. Eight portable extinguishers are distributed throughout the area to fight fire manually.

5.19.5 Adequacy of Fire Protection

The protection for the area does not provide adequate assurance that component cooling will be maintained for shutdown following a fire in this area. The licensee has provided, however, the capability to use raw river water in the component cooling system in the event that this area is involved in an unsuppressed fire.

5.19.6 Modifications

Ten ionization type detectors, two addition portable extinguishers and five manual hose stations will be provided.

We find that, because an alternate water source is available for component cooling, fire protection for the area satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

5.20 Containment (Fire Area No. 30)

5.20.1 Safety-Related Equipment

Components associated with safety injection systems, the chemical and volume control system, the containment HVAC system, and the component cooling system are in the area with the reactor and its associated auxiliaries and instrumentation.

5.20.2 Combustibles

Combustibles in the area include a large quantity of lubrication oil, cable insulation and charcoal in the filters.

5.20.3 Consequences if no Fire Suppression

A fire involving reactor coolant pump lubrication oil could produce a high temperature and release a large amount of heat within a short period of time. It has not been demonstrated that safe shutdown capability can be preserved under the effect of such a fire.

Cables from redundant divisions are generally well separated within containment. It is not credible that more than two out of four redundant channels of cables could be involved in a single fire.

8/23/78 SCR

5.20.4 Fire Protection System

The detection system for the area consists of 33 ionization type smoke detectors and four flame detectors. Eight more ionization type smoke detectors are installed in the ventilation ducts. Eleven portable extinguishers are distributed throughout the area. Containment HVAC charcoal filters are equipped with a deluge system supplied by the containment spray system. Eight local alarm lights are now installed.

5.20.5 Adequacy of Fire Protection

Portable extinguishers are inadequate to suppress a fire involving reactor coolant pump lubrication oil. Access for fire fighting would be difficult due to smoke which may be produced by the fire and due to radioactivity associated with the area.

5.20.6 Modifications

One additional portable extinguisher will be provided.

The licensee has also agreed to provide one of the following:

(1) A lube oil collection system to contain lube oil leakage and to drain leaked oil to a safe place.

(2) A fire suppression system to control a lube oil fire and to protect the reactor components from that fire.

(3) A study for NRC consideration which includes a detailed evaluation of the installation of the lube oil collection system and the lube oil fire suppression system, and a detailed analysis that shows the facility can be safely shutdown in the event of an unmitigated lube oil fire. The unmitigated fire analysis will consider, but is not limited to, localized effects of the fire, effects on containment filters and other combustibles in the containment, as well as pressure and temperature effects throughout the containment building.

The staff's evaluation of the licensee's analysis or proposed modification will be addressed in a supplement to this report.

5.21 Intake Structure (Fire Area No. 31)

5.21.1 Safety-Related Equipment

The safety-related equipment in this area includes the four raw water pumps.

6/7/79 - DCS, TES, WCJ, ...

III. 0. MOD PKG

78-11

(35)

Omaha Public Power District

1623 HARNEY ▪ OMAHA, NEBRASKA 68102 ▪ TELEPHONE 536-4000 AREA CODE 402

June 6, 1979
LIC 79-0059

Director of Nuclear Reactor Regulation
ATTN: Mr. Robert W. Reid, Chief
Operating Reactors Branch No. 4
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Reference: Docket No. 50-285

Gentlemen:

NRC-79-0144

In accordance with Section 3.2.3 of the Fort Calhoun Station Fire Protection Safety Evaluation Report (SER), issued by the Commission on August 23, 1978, the Omaha Public Power District herewith submits five (5) copies of the attached design description for review. The design description proposes a modification to collect and contain reactor coolant pump lubricating oil leaks in order to reduce the probability of a lube oil fire in the containment building.

As indicated in the SER, the Commission must review and approve this modification. As such, it is respectfully requested that a timely review be performed in order that a final design can be accomplished and modifications can proceed on schedule. The District's staff remains available to provide assistance to expedite your review.

Sincerely,

T. E. Short
Assistant General Manager

TES/KJM/BJH:jmm

Attach.

cc: LeBoeuf, Lamb, Leiby & MacRae
1333 New Hampshire Avenue
Suite 1100
Washington, D. C. 20036

REVIEW RECORD

		DATE	CODE
DIN			
IDENTIFIER	Dpm	04/10/87	X,R,D
CHECKER		05/18/87	X,R,D
OFPD		8/24/87	X,D

RELATED TO: LIC-78-0122, NRC-78-0104

3

GSE-B-2-2 FORM	PREPARED BY W. B. Hatch CHECKED BY T. J. Vavra APPROVED C&K	Preliminary Design Description SH. 1 CONT. ON SH. 2
MR NO. FC-78-57	REV. 0 DATE May 24 79	OMAHA PUBLIC POWER DISTRICT GENERATING STA. ENG.

OIC-79-0057

ILLEGIBLE

FORT CALHOUN STATION 1
RCP LUBE OIL COLLECTION
MR-FC-78-57 PRELIMINARY DESIGN

DESIGN DESCRIPTION

A. DESIGN BASIS - REQUIREMENTS

B. TECHNICAL DESCRIPTION

C. ANALYSIS

D. SAFETY EVALUATION

ATTACHMENTS

1. ATTACHMENT 1: DRAWING SHOWING THE EXISTING CONFIGURATION OF THE RCP MOTORS

2. ATTACHMENT 2: DRAWINGS SHOWING THE PROPOSED LUBE OIL COLLECTION SYSTEM ATTACHED TO THE RCP MOTOR

   a. NUS Drawing 1928-L-011
   b. NUS Drawing 1928-L-012
   c. NUS Drawing 1928-L-013
   d. NUS Drawing 1928-L-014

[illegible]

LIC-79-0054

A. DESIGN BASIS

In accordance with the Safety Evaluation Report by the Office of Nuclear Reactor Regulation, U. S. Nuclear Regulatory Commission, Docket No. 50-285, paragraph 3.2.3, page 3-1, a modification will be made to the reactor coolant pump motors to contain a potential lube oil leak and drain the leaked oil to a safe place. This will reduce the probability of a lube oil fire in the Containment Building.

B. TECHNICAL DESCRIPTION

Omaha Public Power District is performing the design and the fabrication and installation supervision for the oil collection system for the four (4) reactor coolant pump motors for Fort Calhoun Station Unit I. The oil collection system is designed to meet the following criteria:

> "These systems would collect oil leaks from the lift pump, oil cooler (if external to reservoir), flanged or gasketed oil connections, oil level sight glasses, drain and fill connection points and oil reservoirs."

Also, the system is designed to contain a pressurized oil leak from a crack in any part of the lubrication oil system external to the pump. The collection system consists of three sealed pans (12-in. deep) connected together with a three piece cover and completely encloses the pressurized oil containing components. The predominant material is 16 gauge, Type 304 stainless steel. Each pan has a 2-in. drain to a collection tank located in the basement. There will be one drain tank for each pair of motors in a RCP/steam generator cavity. The field installed drain piping will have a flexible coupling to the collection system to allow for motor movement. The design philosophy was to design leakproof bottom pans so they would hold the maximum amount of oil that could leak out even if the pan drains were plugged. The tops are designed to contain leaks from pressurized line to prevent oil from being sprayed outside the collection system. The top portion is not leak proof, but seams are designed so that oil sprayed on them will stay inside the collection system. The following additional design criteria are applicable:

1. The following will be performed to assure a satisfactory system:

   Critical dimensions will be field measured, documented and independently verified.

   Design reviews will be conducted at various stages of the design.

   The original designer will follow the system through installation.

   Leak checking of the system will be performed.

   Fabrication and installation will be supervised by the responsible design engineer.

2. The collection system will contain more than 110 gallons of oil in the leakproof pans even if all drains to the basement drain tanks are plugged. One-hundred and ten (110) gallons is the most oil that can leak into the system for any single failure.

3. Adequate ventilation will be provided for the oil lift pump motor.

4. The following items will be incorporated for convenience for motor maintenance:

   Quick access ports for oil cooler tube bundle inspection.

   Quick access latch for fill, level gage, and drain.

   Top and side can be easily removed for access to pressure switches, lift pump, etc.

   Seals will be standard, readily available types.

   The collection system drains can be used for routine draining of oil for maintenance.

5. The collection system will be designed such that a failure of a water pipe to the oil cooler inside the system will not flood inside the motor or cause a structural failure of the system.

6. Large pieces of the system will have lifting lugs for crane attachment.

7. Collection system pieces must be small enough to go into containment through the personnel air lock.

8. The following are applicable to the collection system drain tanks:

   - will be located on the basement floor at Elevation 994'. (The oil cooler is at Elevation 1022.5'.)

   - Capacity will be 150 gallons.

   - Will have a drain and vent with the drain located such that overflow for one pump motor failure is impossible.

   - One drain tank for two pump motors or two 150 gallon tanks total will be provided.

9. The predominant material will be 16 gauge, Type 304 stainless steel.

10. The system can be removed so that the motor can be removed through an eight (8) foot-diameter opening.

11. The largest piece will weigh less than 180 pounds.

12. The following oil system failures will be collected:

- oil cooler housing, drains, inlet and outlet lines.
- lift pump and its inlet and outlet lines.
- drain, fill and level gauge.
- oil cooler tube
- motor shaft oil dam.

The lower oil reservoir is not being collected since it contains only four (4) gallons, has an internal oil cooler and there are no pressurized lines, sight glasses, etc. Also, the oil level transmitter is not contained since the transmitter housing has a pressure rating of 500 psig and it is exposed to only 17 inches of oil.

The preliminary design for the oil collection system is presented by NUS Drawing Numbers 1928-L-011, -012, -013 and -014 (Attachment 2). There will be some minor variations to this basic design for each of the four motors to accommodate interferences in the RCP cavities. Attachment 1 shows the existing motor configuration.

C. ANALYSIS

The following reviews, analyses or calculations will be performed to insure the adequacy of the system:

1. A seismic analysis will be performed to assure the system will not fall on a safety-related item during a safe shutdown earthquake.
2. The collection system will be reviewed for each pump motor/RCP cavity for adequate ventilation of the pump motor.
3. A calculation will be performed to show the impingement of 1000 psig oil will not penetrate the collection system. (UPDATE)
4. An analysis will be performed to show the collection system does not cause motor vibrations.

ILLEGIBLE	PREPARED BY [illegible] CHECKED BY [illegible] APPROVED C-G-K	Preliminary Design Description SH. 5 CONT. ON SH. ____
MR NO. FC-78-57	REV. 0 DATE May 24, 79	OMAHA PUBLIC POWER DISTRICT GENERATING STA. ENG.

AIC-79-0059

D. UNREVIEWED SAFETY QUESTION EVALUATION (10 CFR 50.59)

Procedure/Procedure Change/Modification MR-FC-78-57

I. The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report may be increased:

No. The installation of this system reduces the probability of occurrence of a lube oil fire. It does not have an adverse affect on the operation of any other safety related components. The system will be seismically designed and supported.

II. Possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report may be created:

No. It reduces the probability of fire. The possible effects of its installation on the performance of other equipment indicates that it will not create any adverse circumstances which weren't previously evaluated in the safety analysis report.

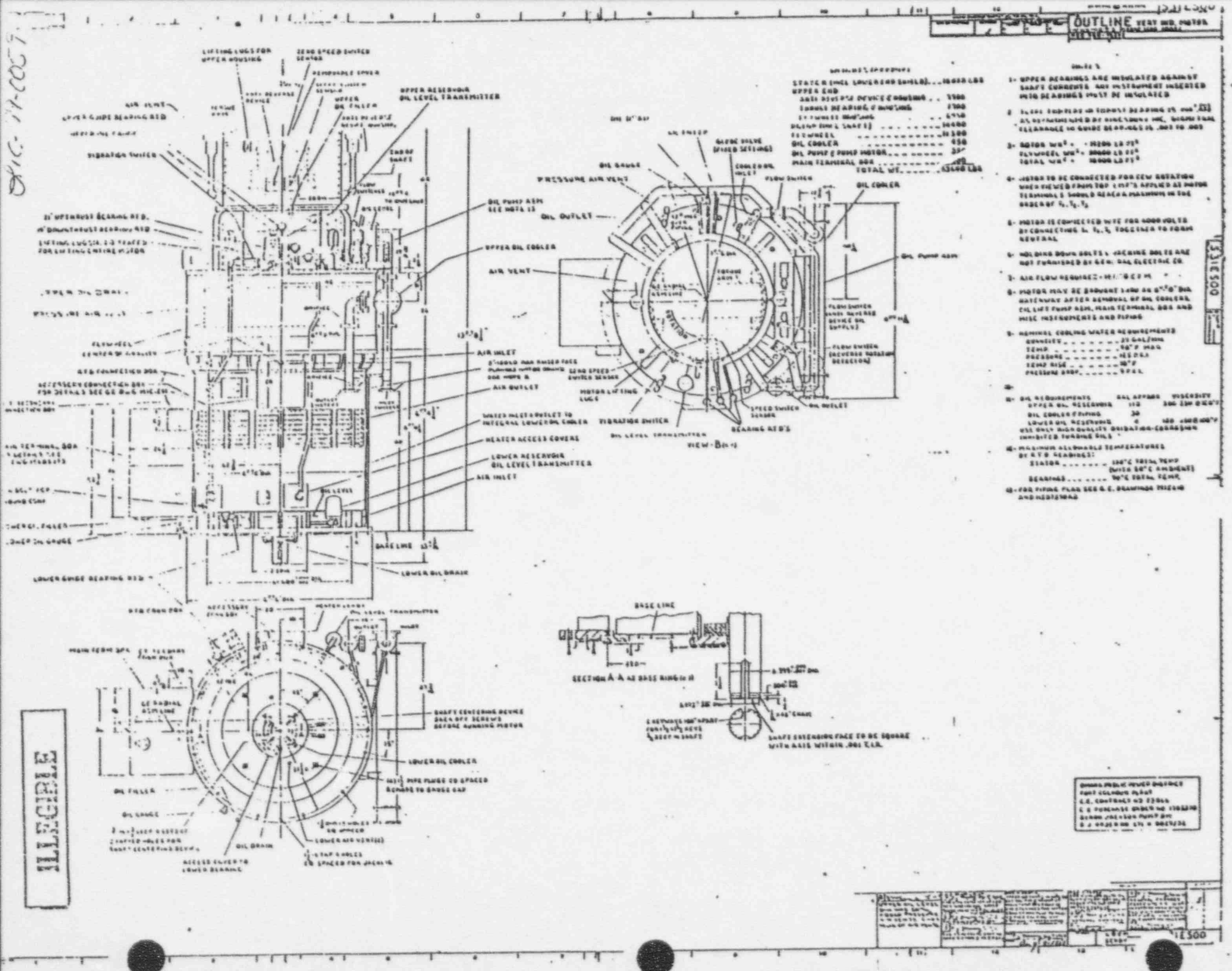
III. The margin of safety as defined in the basis for any technical specification is reduced.

No. It is a passive system with no moving parts. It has been shown not to interfere with or reduce any safety related equipment's function. It reduces the probability of fire and thus could only contribute to increasing the margin of safety.

GIC-79-005

ATTACHMENT 1

EXISTING RCP MOTOR CONFIGJRATION


OUTLINE VERT IND MOTOR
Attachment #1
ELECTRIC
VIEW B-B
SECTION A-A AT BASE RING
BASE LINE
LOWER OIL DRAIN
LOWER OIL COOLER
OIL FILLER
OIL GAUGE
AIR VENT
AIR INLET
AIR OUTLET
OIL OUTLET
OIL PUMP ASM
OIL COOLER
FLOW SWITCH
VIBRATION SWITCH
SPEED SWITCH
HEATER ACCESS COVERS
LOWER RESERVOIR OIL LEVEL TRANSMITTER
UPPER RESERVOIR OIL LEVEL TRANSMITTER
SHAFT CENTERING DEVICE
SHAFT EXTENSION FACE TO BE SQUARE WITH AXIS WITHIN .001 T.I.R.

ATTACHMENT 2

LUBE OIL COLLECTION SYSTEM DRAWINGS

A. NUS DRAWING 1928-L-011
B. NUS DRAWING 1928-L-012
C. NUS DRAWING 1928-L-013
D. NUS DRAWING 1928-L-014

MICRO LOC [illegible]

APERT LOC OOOA-9856

Omaha Public Power District

DOCUMENT DISPOSITION

* Parent Document Name: Communications to Nuclear Regulatory Commission for 1979

Parent Document Retrieval No.:

* Document/Drawing Name: Safety Injection and Containment Spray Syst. P&I Diagram.

* Document/Drawing Number: E-2381a-210-130

** Sheet Number: 1 of 2 Rev. Number: 09

* Retrieval Number: →

** ☒ Microfilmed on: ☒ Aperture Card, ☐ 16mm Cartridge

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* ATTACHMENT TO OIC-79-0359,
Dated - 8-31-79.

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RMSF-042

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DOCUMENT DISPOSITION

* Parent Document Name: Correspondence to Nuclear Regulatory Commission for FTF.

Parent Document Retrieval No.: _____

* Document/Drawing Name: Metal Clad Switchgear Interconnection Diagram.

* Document/Drawing Number: 0CED81.74

** Sheet Number: 3 Rev. Number: 4

* Retrieval Number: _____

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Date: 3-15-74

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MICRO LOC 0770777

APERT LOC 0000A-9058

Omaha Public Power District

DOCUMENT DISPOSITION

* Parent Document Name: Correspondence to Nuclear Regulatory Commission for 1979.

Parent Document Retrieval No.:

* Document/Drawing Name: 4.16 kV Switchgear Schematic

* Document/Drawing Number: 11405-E-24

** Sheet Number: — Rev. Number: 9

* Retrieval Number:

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Dated 6-18-79

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RMSF-042

MICRO LOC [illegible]

APERT LOC CCCA-9059

Omaha Public Power District

DOCUMENT DISPOSITION

* Parent Document Name: Correspondence to Nuclear Regulatory Commission for 1979.

Parent Document Retrieval No.: _____

* Document/Drawing Name: Fire Diagram Floor Heater Freshwater & Diagram

* Document/Drawing Number: 11405-M-253

** Sheet Number: _____ Rev. Number: 1

* Retrieval Number: _____

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Date, 11-4-79

PLEASE REFER TO RMS APERATURE CARD NO. OOBA-9059.

RMSF-042

MICRO LOC 10004015??
APERT LOC 000A-9060

Omaha Public Power District

DOCUMENT DISPOSITION

* Parent Document Name: Correspondence to Nuclear Regulatory Commission for 1979.

Parent Document Retrieval No.: ____

* Document/Drawing Name: Flow Diagram Steam ...

* Document/Drawing Number: 11405-M-252

** Sheet Number: ____ Rev. Number: 14

* Retrieval Number: ____

** [X] Microfilmed on: [X] Aperture Card, [ ] 16mm Cartridge

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[ ] Attachment(s) not available (Specify): ____

[ ] Supplemental Indexing Information (Specify in Remarks).

* [X] Special Instructions, Remarks, Details, etc.:

* ATTACHMENT TO LIC-79-0059;

Dated; 4-25-79

PLEASE REFER TO RMS APERATURE CARD NO. 000A-9060.

RMSF-042

MICRO LOC 1004 0580

APERT LOC 0004A-9001

Omaha Public Power District

DOCUMENT DISPOSITION

* Parent Document Name: Correspondence to Nuclear Reg. Comm. for FFA.

Parent Document Retrieval No.:

* Document/Drawing Name: Process Water Flow Diagram

* Document/Drawing Number: 11405-M-100

** Sheet Number: — Rev. Number: 11

* Retrieval Number: —

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Dated 8-23-79

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RMSF-042

MICRO LOC 0240:207

APERT LOC DDDA-90x02

Omaha Public Power District

DOCUMENT DISPOSITION

* Parent Document Name: Code Requirements Nuclear Power Plant Components Commission for ASME

Parent Document Retrieval No.:

* Document/Drawing Name: Auxiliary Feedwater Component Cooling System Flow Diagram

* Document/Drawing Number: 11405-M-40

** Sheet Number: 2 Rev. Number: 9

* Retrieval Number: —

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CTO LOC 1024 01 582
PERT LOC CCCA-9063

Omaha Public Power District

DOCUMENT DISPOSITION

* Parent Document Name: Correspondence to Nuclear Regulatory Commission for 1979.

Parent Document Retrieval No.:

* Document/Drawing Name: Auxiliary Coolant Component Cooling System Flow Diagram

* Document/Drawing Number: 1147E-M-D

** Sheet Number: 1 Rev. Number: 11

* Retrieval Number:

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RMSF-042

MICRO LOC 8204015B3

APERT LOC 8208A-9064 **Omaha Public Power District**

DOCUMENT DISPOSITION

* Parent Document Name: CORRESPONDENCE TO NUCLEAR REGULATORY COMMISSION FOR 1979.

Parent Document Retrieval No.:

* Document/Drawing Name: AUXILIARY BUILDING HEATING AND VENTILATING FLOW DIAGRAM

* Document/Drawing Number: 11405-M-2

** Sheet Number: — Rev. Number: 11

* Retrieval Number: —

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DATED 1-11-72

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MICRO LOC 1004D:584
APERT LOC CCCA-9665

AIC-79-0059

Omaha Public Power District

DOCUMENT DISPOSITION

* Parent Document Name: Correspondence to Nuclear Regulatory Commission for 1979.

Parent Document Retrieval No.:

* Document/Drawing Name: Containment Heating, Cooling and Ventilating Flow Diagram

* Document/Drawing Number: 11405-M-9

** Sheet Number: — Rev. Number: 14

* Retrieval Number:

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DATED 6-6-79

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RMSF-042

Omaha Public Power District

DOCUMENT DISPOSITION

* Parent Document Name: Correspondence to Nuclear Regulatory Commission for 1979

Parent Document Retrieval No.:

* Document/Drawing Name: Safety Injection and Containment Spray System P&I Diagram

* Document/Drawing Number: E-23566 210-130

** Sheet Number: 2 of 2 Rev. Number: 13

* Retrieval Number:

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Dated 8-31-79.

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RMSF-042

MICRO LOC 1007015586
APERT LOC 00004-9063

Omaha Public Power District

DOCUMENT DISPOSITION

* Parent Document Name: Correspondence to Nuclear Regulatory Commission for 1979.

Parent Document Retrieval No.:

* Document/Drawing Name: Chemical and Volume Control System P&I Diagram

* Document/Drawing Number: E-2381-610-120

** Sheet Number: 1 of 2 Rev. Number: 8

* Retrieval Number:

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RMSF-042

MASTER FILE FUNCTIONS

01 - FILE# DISPLAY
02 - FILE# SEARCH
03 - VENDOR NAME SEARCH
04 - SYSTEM CODE SEARCH
05 - DESCRIPTION KEYWORD SEARCH
06 - NEXT AVAILABLE FILE#
07 - FILE# ENTRY
08 - FILE# CHANGE
09 - FILE# DELETE
10 - SYSTEM CODE ENTRY/CHANGE
11 - VENDOR NAME ENTRY/CHANGE
12 - DESC KEYWORD ENTRY/CHANGE
13 - SECURITY MAINTENANCE

TRANSACTION FILE FUNCTIONS

21 - FILE# MAINTENANCE
22 - SYSTEM CODE MAINTENANCE
23 - VENDOR NAME MAINTENANCE
24 - DESC KEYWORD MAINTENANCE
25 - SECURITY MAINTENANCE

FUNCTION 08 LOCATION FC1 FILE# 00 FRAME# SYSTEM
VENDOR VENDOR#
DESCRIPTION KEYWORD PASSWORD

CHANGE COMPLETED

*** DRAWING CONTROL SYSTEM ***
*** FILE# SEARCH SCREEN ***
FUNCTIONS
1 - CONDENSED DRAWING INQUIRY
2 - DRAWING INQUIRY

FUNCTION 1 LOCATION FC1 TAG# SYSTEM
VENDOR VENDOR# 0096
DESCRIPTION KEYWORD CONTRACT#
DRAWING# E-23866-210-110 SHEET#

SEARCH COMBINATION NOT ALLOWED

*** DRAWING CONTROL SYSTEM ***
*** FILE# SEARCH SCREEN ***
FUNCTIONS

FOLDED DOCUMENT

GIC-79-0059

2 - DRAWING INQUIRY

FUNCTION 1 LOCATION FC1 TAG# SYSTEM

VENDOR VENDOR# 0096

DESCRIPTION KEYWORD CONTRACT#

DRAWING# E-23866-210-110 SHEET#

SEARCH COMBINATION NOT ALLOWED

FOLDED DOCUMENT

MICRO LOC 1004 [illegible]

APERT LOC 0004-0161

LIC-79-0057

Omaha Public Power District

DOCUMENT DISPOSITION

* Parent Document Name: Correspondence to Nuclear Regulatory Commission for 1979.

Parent Document Retrieval No.: _____

* Document/Drawing Name: Reactor Coolant System P-I Diagram

* Document/Drawing Number: E-2741-210-110

** Sheet Number: _____ Rev. Number: 11

* Retrieval Number: _____

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* ATTACHMENT TO LIC-79-0059;
Dated 5-10-68

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RMSF-042

SER 11/17/80

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 53 TO FACILITY OPERATING LICENSE NO. DPR-40

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION, UNIT NO. 1

DOCKET NO. 50-285

Introduction

On February 14, 1978 the NRC issued Amendment No. 38 to the Fort Calhoun Station, Unit 1 Operating License which incorporated into the Facility Technical Specifications the elements of the then existing fire protection systems and administrative controls. Following further evaluation of the fire protection program at the Fort Calhoun Station, the staff issued Amendment No. 40 on August 23, 1978, which incorporated a license condition related to the completion and implementation of fire protection modifications. Subsequent to August 23, 1978, the licensee has submitted additional information and proposed revisions to the fire protection program. The staff has reviewed this additional information and has made the following findings which are presented in the order of, and with the same numerical designations as, the items listed in the August 23, 1979 SER. This SER supplements the August 23, 1978 SER.

Discussion and Evaluation

Item 3.1.4 - Fuel Tank for Diesel Driven Fire Pump

SER Section 3.1.4 indicates that a modification will be made to prevent structural steel framing in the vicinity of the fuel storage tank, supplying the diesel engine-driven fire water pump, from being damaged by a fire at the tank.

By letter dated August 23, 1978, the licensee proposed to provide a reinforced concrete block enclosure around the diesel fuel tank, and fill the space between the tank and the enclosure walls with sand and/or limestone.

The proposed modification effectively buries the tank and eliminates it as a possible fire hazard. However, the proposed arrangement of liquid level indicator and drain line does not sufficiently eliminate the possibility of a diesel fuel leak which could present a fire hazard to the intake structure. Therefore, the staff recommends the following modifications or equivalent alternatives be incorporated:

Item 3.2.3 - Reactor Coolant Pump Oil Collection System

SER Section 3.2.3 indicates that the licensee will provide one of the following:

1) A lube oil collection system to contain lube oil leakage and to drain leaked oil to a safe place.

2) A fire suppression system to control a lube oil fire and to protect the reactor components from that fire.

3) The results of a study demonstrating that safe shutdown will not be impaired in the event of an unmitigated reactor coolant pump lube oil fire.

By letter dated June 6, 1979, the licensee proposed to install lube oil collection systems and provided the design description and drawings for the proposed systems.

The staff has reviewed this information and find that our concern has been satisfactorily addressed. We consider this issue to be closed.

Item 3.2.4 - Cable Separation

(See item 3.1.15)

Technical Specifications

The revisions to the Technical Specifications issued with this License Amendment are, for the most part, additions to incorporate the various modifications which were required by the staff. A number of separate applications had been submitted to incorporate added fire detection and suppression systems, these applications were combined and the entire section of fire protection Technical Specifications was updated to the currently approved version of the Standard Technical Specifications with the agreement of the licensee. Since the changes to the Technical Specifications incorporate additional NRC requirements and are in accordance with these currently approved, we find the Technical Specifications to be acceptable.

Summary

The staff has completed the review of all fire protection information submitted to date, except for Alternate Shutdown Capability, and, as discussed above, has reached satisfactory resolution on all items listed in Tables 3.1 and 3.2 of our August 23, 1978 SER with the exception of the following:

UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-285

OMAHA PUBLIC POWER DISTRICT

NOTICE OF ISSUANCE OF AMENDMENT TO FACILITY OPERATING LICENSE

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 53 to Facility Operating License No. DPR-40 issued to Omaha Public Power District (the licensee), which revised the Technical Specifications for operation of the Fort Calhoun Station, Unit No. 1, located in Washington County, Nebraska. The amendment is effective as of its date of issuance.

This amendment changes the Technical Specifications to incorporate additional fire protection requirements.

The applications for the amendment comply with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act, and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment. Prior public notice of this amendment was not required since the amendment does not involve a significant hazards consideration.

The Commission has determined that the issuance of this amendment will not result in any significant environmental impact and that pursuant to 10 CFR §51.5(d)(4) an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

For further details with respect to this action, see (1) the licensee's submittals dated October 4, 1978, January 22, May 30, and October 9, 1979, and August 20, 1980, as supplemented, (2) Amendment No. 53 to License No. DPR-40, and (3) the Commission's related Safety Evaluation. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N. W., Washington, D. C., and at the W. Dale Clark Library, 215 South 15th Street, Omaha, Nebraska. A copy of items (2) and (3) may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, Attention: Director, Division of Licensing.

Dated at Bethesda, Maryland, this 17th day of November 1980.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert A. Clark, Chief
Operating Reactors Branch #3
Division of Licensing

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TEXAS 76011

SEP 23 1988

In Reply Refer To:
Docket: 50-285/88-28

88-880

Omaha Public Power District
ATTN: Kenneth J. Morris, Division Manager
Nuclear Operations
1623 Harney Street
Omaha, Nebraska 68102

Gentlemen:

This refers to the inspection conducted by Messrs. M. E. Murphy, R. P. Mullikin, and C. E. Johnson of this office during the period August 22-26, 1988, of activities authorized by NRC Operating License DPR-40 for the Fort Calhoun Station, and to the discussion of our findings with Mr. W. G. Gates and other members of your staff at the conclusion of the inspection.

Areas examined during the inspection included the fire protection/prevention program, the triennial postfire safe shutdown capability reverification, and followup on previously identified items. Within these areas, the inspection consisted of selective examination of procedures and representative records, interviews with personnel, and observations by the NRC inspectors. The inspection findings are documented in the enclosed inspection report.

During this inspection, it was found that certain of your activities were in violation of NRC requirements. Consequently, you are required to respond to these violations, in writing, in accordance with the provisions of Section 2.201 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations. Your response should be based on the specifics contained in the Notice of Violation enclosed with this letter.

Two unresolved items are identified in paragraphs 4 and 5 of the enclosed inspection report.

We have also examined actions you have taken with regard to previously identified inspection findings. The status of these items is identified in paragraph 2 of the enclosed report.

The response directed by this letter and the accompanying Notice is not subject to the clearance procedures of the Office of Management and Budget as required by the Paperwork Reduction Act of 1980, PL 96-511.

WCJ, MOG, RLA, KJM, KCH, RKS, RCK, JJF, JMW, BRH, FCS, JBK, DJM, FILE, JRG, RB, DKD, HMT, BC, RKB, JS, RCD, JM, LLZ, FFF, KET, LLG, RGE, CFS, SARC, RDP 10/3,

5

- FC87-026, "Transfer of the P250 Computer Functions to the MODCOMP Computer"
- FC87-037, "Diesel Generator Electrical Modifications"
- FC88-060, "Diesel Exhaust Seismic Supports"

The NRC inspectors reviewed the OPPD Generating Station Engineering Guides GEG-3, "Preparation of Design Packages," and GEG-4, "Fire Protection System Interaction" which instructs the reviewer on possible safe shutdown effects due to plant modifications. These procedures appeared adequate to perform their intended functions.

No violations or deviations were identified.

b. Emergency Lighting

A review was performed of the adequacy of emergency lighting required to perform the safe shutdown functions when a fire requires the evacuation of the control room.

In a previous NRC inspection in January 1988, it was noted that when exiting the control room, after a fire, the operators must travel along a corridor to the stairway leading down to the alternate shutdown panel and the switchgear rooms. The operators would have had to rely on the use of hand-held lights and battery powered exit signs for illumination in this corridor. NRC Region IV requested from NRC Headquarters a clarification of the adequacy of this emergency lighting. Their response on June 23, 1988, stated that the reliance on hand-held lights and exit signs for illumination does not satisfy the technical requirements of Section III.J of Appendix R to 10 CFR Part 50.

Section III.J of Appendix R states that "Emergency lighting units with at least an 8-hour battery power supply shall be provided in all areas needed for operation of safe shutdown equipment and in access and egress routes thereto." Thus, the licensee does not satisfy this requirement. This is an apparent violation. (285/8828-02)

The licensee, at the exit interview, committed to performing compensatory measures for the lack of adequate emergency lighting in the control room corridor. They have subsequently installed, as verified by the senior resident inspector, a battery powered emergency lighting unit in the corridor. The unit has two lamps which are directed in such a direction to allow for adequate emergency illumination for operators travelling this corridor.

c. Reactor Coolant Pump Oil Collection System

The NRC inspectors reviewed the design of the reactor coolant pump oil collection system. The design appeared adequate with the

NRC Inspection Report 1988 (Sept)

exception of the capacity of the oil collection tanks. Section III.O of Appendix R requires that oil leakage be collected and drained to a vented closed container that can hold the entire lube oil system inventory. The licensee's design is for two collection tanks with a capacity of 150 gallons each. Each of the four reactor coolant pumps has an oil capacity of less than 115 gallons. Thus, there is a total tank capacity of 300 gallons to collect a total oil supply of approximately 460 gallons. However, according to the FCS Fire Hazard Analysis the largest oil leak has been determined to be less than 80 gallons total.

Since the oil collection system, including collection pans, drain lines, and collection tanks has enough capacity to hold all of the oil from the pumps, there appears to not be a safety concern. However, the present system does not comply with Section III.O of Appendix R and an exemption is required. This will be considered an unresolved item pending the licensee's submittal and NRR's review and acceptance of the exemption request for the reactor coolant pump oil collection system. (285/8828-03) #3

No violations or deviations were identified.

5. Prestressing Post-Tensioning System (61701)

During the inspection of the fire area barrier in the upper electrical penetration room, tendon grease was observed on the fire barrier seal. Tendon grease was also observed on the outer perimeter of the tendon buttress. The NRC inspectors asked the licensee two questions: (1) has the tendon grease been isolated to a specific location; and (2) is the tendon grease leakage within acceptable limits.

The licensee could not address the issue at the time; however, they did inform the NRC inspectors that Inryco performed the surveillance requirements for the prestress tendon system as required by TS and found no significant problems.

Prior to the exit interview the licensee gave the NRC inspector the surveillance report performed by Inryco. The NRC inspector reviewed the results of the report. The results indicated that the tendons were observed for tendon grease volume and were within the acceptance criteria. Even though the results of the last surveillance requirements were acceptable, the NRC inspector noted that since the surveillance report only included a sampling of the tendons, there may be tendons that were not included in the sample selection performed by Inryco. These tendons may not have an adequate volume of grease which could leave insufficient corrosion protection. This issue was discussed with licensee personnel at which time the NRC inspector stated that a determination of what tendons are leaking grease and if this grease leakage has affected tendon operability needs to be conducted. #4

This is considered to be an Unresolved Item (50-285/8828-04).

LIC-88-1066

(13)

Omaha Public Power District
1623 Harney Omaha, Nebraska 68102-2247
402/536-4000

RJT #6

November 28, 1988
LIC-88-1066

App R III.O

EXEMPTION REQUEST

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, DC 20555

References:
1. Docket No. 50-285
2. Amendment No. 40 to OPPD Operating License No. DPR-40 dated August 23, 1978.
3. Letter to NRC (R. W. Reid) from OPPD (T. E. Short) dated June 6, 1979
4. SER for Amendment No. 53 to OPPD Operating License No. DPR-40 dated November 17, 1980

Gentlemen:

SUBJECT: Exemption Request from 10 CFR 50 Appendix R, Section III.O, "Oil Collection System for Reactor Coolant Pumps"

Omaha Public Power District (OPPD) is requesting an exemption pursuant to 10 CFR 50.12 from the requirements of section III.O of Appendix R to 10 CFR 50 for the reactor coolant pump oil collection tank holdup capacity. The NRC has reviewed and approved the current tank capacity (Reference 4) which was based on Appendix A to Branch Technical Position 9.5-1, prior to the issuance of Appendix R.

Attachment 1 to this letter provides the detailed description and justification for this exemption request. Attachment 2 provides answers to questions raised during a November 25, 1988 telephone call between D. Kubicki of NRR and my staff. Attachment 3 provides a description of the fire area as contained in the Updated Fire Hazards Analysis.

6

As discussed in a telephone conference on November 23, 1988, between P. D. Milano of the NRC and members of my staff, it is requested that this exemption be approved prior to startup which is currently scheduled for December 25, 1988. Accordingly, please find attached a check in the amount of $150.00 pursuant to 10 CFR Part 170. If you have any questions, please contact us.

Sincerely,

K. J. Morris
Division Manager
Nuclear Operations

Attachments

KJM/sa

c: LeBoeuf, Lamb, Leiby & MacRae
R. D. Martin, NRC Regional Administrator
P. D. Milano, NRC Project Manager
P. H. Harrell, NRC Senior Resident Inspector

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of

Omaha Public Power District
(Fort Calhoun Station
Unit No. 1)

Docket No. 50-285

AFFIDAVIT

K. J. Morris, being duly sworn, hereby deposes and says that he is the Division Manager - Nuclear Operations of the Omaha Public Power District; that as such he is duly authorized to sign and file with the Nuclear Regulatory Commission the attached information concerning the Exemption Request from 10 CFR 50 Appendix R, Section III.O, "Oil Collection System for Reactor Coolant Pumps"; that he is familiar with the content thereof; and that the matters set forth therein are true and correct to the best of his knowledge, information, and belief.

K. J. Morris
Division Manager
Nuclear Operations

STATE OF NEBRASKA)
) ss
COUNTY OF DOUGLAS)

GENERAL NOTARY-State of Nebraska
L. PATRICK WALLING
My Comm. Exp. Jan. 1, 1990

Subscribed and sworn to before me, a Notary Public in and for the State of Nebraska on this 28th day of November, 1988.

L. Patrick Walling
Notary Public

Attachment 1

A. Background

In 1978, OPPD was issued Amendment 40 to the Fort Calhoun Station Unit 1 Operating License which contained a license condition related to the completion of several fire protection modifications. SER section 3.2.3 indicated that OPPD would provide one of the following:

1) A reactor coolant pump lube oil collection system to contain lube oil leakage and to drain leaked oil to a safe place.
2) A fire suppression system to control a lube oil fire and to protect the reactor components from that fire.
3) The results of a study demonstrating that safe shutdown will not be impaired in the event of an unmitigated reactor coolant pump lube oil fire.

By a letter dated June 6, 1979, OPPD proposed to install lube oil collection systems and provided the design description and drawings for the proposed systems. The NRC, in the SER for Amendment 53 to the Fort Calhoun Station Unit 1 Operation License dated November 17, 1980, stated that "the staff has reviewed this information and find that our concern has been satisfactorily addressed. We consider this issue to be closed." Subsequent to this, 10 CFR 50 Appendix R Section III.O which requires a collection system be provided for each reactor coolant pump, the leakage from which "shall be collected and drained to a vented closed container that can hold the entire lube oil system inventory" was issued and applied to facilities licensed prior to January 1, 1979.

B. Description

Each of the four reactor coolant pumps at Fort Calhoun Station contains 140 gallons of lube oil. The previously accepted lube oil collection system was designed to contain "oil leaks from the lift pumps, oil coolers, flanged or gasketed oil connection, oil level sight glasses, drain and fill connection points, and oil reservoirs." The system consists of three sealed pans and covers which enclose the pressurized oil containing components of each reactor coolant pump with a two inch drain line routed to one of two 150 gallon collection tanks, one for each pair of reactor coolant pumps. The collection tank capacity was based on a maximum expected leak of 110 gallons for any single failure as opposed to a two pump inventory of 280 gallons for each of the two collection tanks.

Each horizontally positioned tank is equipped with an overflow drain located at the top of the tank drains to the floor. The tanks are located between and below the reactor coolant pump cavities at basement elevation 994 ft., approximately 23 ft. below the collection pans. Assuming a simultaneous failure of all four lubricating oil systems, the entire inventory of oil will be discharged to the collection system. This would result in a maximum of 130 gallons of lube oil overflowing onto the containment basement floor at each tank location from the overflow drains, and into the nearest 4 inch floor drain. The basement floor in the area of

each tank is sloped to the nearest floor drain, which is within 12 feet of the collection tank for reactor coolant pumps RC-3C and RC-3D, and within 4 feet of the collection tank for pumps RC-3A and RC-3B. In each area oil would temporarily pool and would be contained by the floor drain.

A walkdown was done to determine if any potential ignition sources are located in the vicinity of the tanks and floor drains. Based on the results of this walkdown, no potential ignition sources were identified at or below the level of the tank. The maximum overflow of oil resulting from the loss of the entire oil system inventory from all four reactor coolant pumps does not pose a hazard to the ability of the facility to safely shutdown or represent a significant exposure hazard to the fire area itself. Additionally, the most recent revision of the Fire Hazards Analysis [Paragraph (b), page 119 as provided in Attachment 3] describes the evaluation of the effects of a lube oil fire in the reactor coolant pump cavities and shows it to have no adverse effect on safe shutdown. The fire area is also equipped with an area wide fire detection system to give prompt notification to plant staff so that manual fire fighting may be initiated.

C. Exemption Request

The District requests an exemption, pursuant to Sections 50.12(a) and 50.48(c) of 10 CFR, from the requirements of Section III.O of Appendix R. Specifically, exemption is requested for Fire Area 30 from the requirements that the lube oil collection system drain tank capacity be capable of holding the entire lube oil system inventory of the reactor coolant pumps. This requirement is unnecessary to assure the capability to safely shutdown the plant in the event of any credible fire for the reasons listed above.

The following are questions raised about the Reactor Coolant Pump Oil Collection System by D. Kubicki in a telephone communication dated November 25, 1988.

Question 1

NRR was told by a Regional Inspector that the entire system tanks, piping, etc. when taken as an entity would contain the total inventory of all four pumps. Is this a true statement? Please provide an explanation.

Answer

The total volume of one collection pan and its associated piping is approximately 120 gallons (110 gallon pan capacity + capacity of approximately 50 feet of nonshared 2 inch drain piping of 10 gallons). This gives a total two pump system capacity of approximately 390 gallons (120 gallons + 120 gallons + 150 gallon tank). However, there is no mechanism installed that would prevent the entire volume of oil collected from draining into the collection tank and out of the overflow. Therefore 130 gallons of oil could potentially flow out of the overflow for the worst case oil loss scenario.

Question 2

The system was seismically designed:

a. Does this mean that the piping will not fail?
   or
b. Is the piping designed to 2 over 1 criteria so that it can fail but not fall? If so, can we state that where ever the line fails, that the oil leakage will not contact a potential ignition source?

Answer

The system was designed with flexible couplings to prevent the piping from leaking due to motion. The piping design criteria was to survive an SSE with its leak integrity intact. In the event the piping were to leak, the potential ignition sources in the area consist of reactor coolant system components with surface temperatures above 500°F. The scenario of a reactor cavity lube oil fire has been shown to have no adverse effects on safe shutdown (Attachment 3, attached).

Question 3

OPPD states that the system will contain oil from pressurized points. What about unpressurized points?

Answer

The oil piping that is unpressurized is either internal to the motor bearing assembly or of such a high pressure rating that oil leakage is not considered a credible event. The total volume of the unpressurized oil system in the lower bearing assembly is only four gallons per pump. The entire upper bearing assembly is provided with collection capacity with the exception of the level transmitters which are rated at 500 psig.

Fire Area 30 — Containment

Elevation 989', 1013', and 1045'
Controlled Access
Safety Related

Location, Exposures, and Construction

The containment structure is located in the center of the auxiliary building. It is bordered on the east by the electrical penetration area (Fire Areas 34A and 34B), valve area II (Fire Area 16), and the condensate and service water tank area (Fire Area 43); on the north by the basement level general area (Fire Area 6), the mechanical penetration area (Fire Area 13), the ground floor general area (Fire Area 20), the pipe penetration area (Fire Area 23), the sampling room (Fire Area 24), the work area (Fire Area 28) and the HVAC Equipment and Fuel Handling Area (Fire Zone 20.7); on the west by the HVAC Equipment and Fuel Handling Area (Fire Zone 20.7), the ground floor general area (Fire Area 6); and on the south by exterior walls, diesel generator room 2 (Fire Area 35B) and the equipment hatch enclosure (Fire Area 40).

All walls separating this area from the other mentioned areas are 3-hour fire rated barriers, although penetration seals are not specifically fire rated. Access hatches are located in Fire Areas 20 and 40. Penetrations are sealed. (The 42" ducts from Fire Area 30 to Fire Zone 20.7 are not provided with rated fire dampers.)

The containment consists of three floors: basement (989'), ground (1013'), and operating (1045'). These are connected by two unenclosed stairwells. The reactor, two steam generators, pressurizer and four primary coolant pumps are enclosed in concrete cells running vertically through all three floors. The area per floor is approximately 4860 square feet. Ceiling heights vary from 19 feet to 62 feet.

Major Safety Related/Safe Shutdown Equipment and Cabling

A) Safety Injection System
- Safety Injection Tank SI-6A
- Safety Injection Tank SI-6B
- Safety Injection Tank SI-6C
- Safety Injection Tank SI-6D
- Safety Injection Control Panel AI-136-A,B,C,D
- Low Pressure Safety Injection control Panel AI-140, A,B,C,D

B) Chemical and Volume Control System
- Regenerative Heat Exchanger CH-6

C) Containment HVAC system
- Containment Air Cooling and Filtering Unit VA-15A
- Containment Air Cooling and Filtering Unit VA-15B
- Detector Well Air Cooling Unit VA-13A
- Detector Well Air Cooling Unit VA-13B

D) Component Cooling System
- Component Cooling Water Cooling instrument racks AI-138, A,B,C,D
- Component Cooling Lube Oil Cooling instrument racks AI-139, A,B,C,D

E) Reactivity Control
- Control Rod Drive motors, cables, and associated cables

F) RCS Pressure Control System
- PORV'S PCV-102-1 and PCV-102-2
- Pressurizer Heaters
- Auxiliary Pressurizer Spray Valves HCV-240 and HCV-249
- Pressurizer level transmitters LT-101X, LT-101Y, and LT-106
- High range (A,B,C, and D P-102), low range (P-118), and wide range (P-105 and P-115) channels of pressure indication.

G) Auxiliary Feedwater System
- Isolation Valves HCV-1107A and HCV-1108A and associated cables

H) Steam Generator System

- Pressure and level instruments, as follows:

Steam Generator RC-2A	Steam Generator RC-2B
A/L-901, A/L-911	A/L-904, A/L-912
B/L-901, B/L-911	B/L-904, B/L-912
C/L-901, C/L-911	C/L-904, C/L-912
D/L-901, D/L-911	D/L-904, D/L-912
A/P-902, A/P-913	A/P-905, A/P-914
B/P-902, B/P-913	B/P-905, B/P-914
C/P-902, C/P-913	C/P-905, C/P-914
D/P-902, D/P-913	D/P-905, D/P-914
L-903X, L-903Y	L-906X, L-906Y
P-907	P-908

I) Reactor Coolant System

- Hot and Cold leg temperature instrumentation

J) Neutron Flux Monitoring System

- Wide-range excore neutron flux detectors

K) Charging System

- Isolation valves HCV-238, HCV-239, HCV-247, and HCV-248.

There are four safety related divisions of cables in the containment. Much of the cabling is enclosed in conduit. (See the Safe Shutdown Analysis for Additional Detail on cabling.)

Combustible Material	Quantity	Combustible Load
Basement Level - Steam Generator Cell A		
None	(lube oil drain tank is normally empty)	
Basement Level - Steam Generator Cell B		
None	(lube oil drain tank is normally empty)	
Ground Level		
Lubricant	620 gal.	6592 btu/ft^2
Operating Level		
Lubricant	56 gal.	595 btu/ft^2

Transient materials are provided during outages only when the plant is in a safe cold shutdown condition.

Total cable insulation in Fire Area 30 is 19,500 lbs. This yields a combustible loading for cable insulation of 16,049 btu/ft^2.

Fire Detection

The fire detection system in containment includes thirty-three ionization type detectors located as follows:

a) Thirteen (13) high voltage pyrotronics detectors are located on the bottom face of the beam at floor elevation 1013'-0". The detectors are located in the immediate area of concentrations of combustibles, between the combustibles (i.e. cable trays) and the grating. Any fire generated would be detected, since the detectors are in the path of the fire plume.

(b) Thirteen (13) detectors are located on the bottom face of the beam at floor elevation 1045'-0". In addition, three (3) detectors are located below a partial landing at elevation 1060'-0". All the detectors are located in the immediate area of the concentrations of combustibles providing adequate coverage.

(c) One (1) flame detector and one (1) ionization detector are located in the cavity above each main coolant pump on the intermediate level for coverage against a lube oil fire which is the major fire loading in this area.

(d) Eight (8) duct detectors are located throughout the containment HVAC system.

All detectors provide alarm and annunciation locally via eight alarm lights as well as in the control room.

Fire Suppression

A water spray system using the borated containment spray water supply is available inside the HVAC charcoal filter units. Extinguishers are located throughout containment. There are no manual hose stations in this area, however, in the event hose is called for it could be brought in through the containment airlock from Fire Area 20.

Effect of Design-Basis Fire on Safe Shutdown

Safe plant shutdown is assured during a fire in containment (Fire Area 30) by satisfying the requirements of Appendix R or NRC approved exemption requests for equivalent protection.

Where two redundate trains of cable are routed within 20 feet of each other, or where redundant components are located less than 20 feet apart, radiant energy shields have been erected between the two trains. Where shielding methods were impractical, an exemption from the NRC with respect to 10 CFR 50 Appendix R, Section III.G. requirements was requested. The areas of noncompliance where exemptions were requested include:

(a) Directly beneath the pressurizer vessel at elevation 1014' where redundant trains of pressurizer heater cables converge. This area is completely inside the pressurizer bay where the only combustibles are these cables, the insulation of which is qualified to a test comparable to IEEE-383. Due to the intermixing of the redundant cables as they lead to the individual pressurizer heaters, no possible physical means exist to provide additional physical separation or protection.

(b) Other cases where there exists at least 20 feet of separation between redundant cables, but some intervening combustibles may be present (typically IEEE-383 qualified cable.)

The exemption was granted by the NRC on July 3, 1985.

Due to the large volume in the containment (which is divided into three floors with several cell-like compartments) it is more informative to examine the consequences of a fire on each of the three floor levels.

Postulated Fire A: (Basement level) The lubrication oil for one of the primary coolant pumps is assumed to ignite as a result of a leak in the lubrication system. The location is on the basement elevation within the concrete cell that encloses two primary coolant pumps and a steam generator.

Either the flame or the ionization detectors would give an alarm to the control room if the postulated fire occurs. The brigade would then be dispatched to effect manual fire suppression.

Early warning could allow the operator time to accomplish an orderly reactor shutdown and to trip off that pumps lubrication system which may serve to eliminate the source of the burning oil. The insulation on the primary coolant boundary would protect it from the maximum fire severity that could be expected in this concrete cell. The massive structural hangers of the primary coolant system would not be affected by a fire of this severity.

The four reactor coolant pump motors (less than 115 gallons each) have been provided with an oil collection system designed to contain a lube oil leak and drain the leaked oil to a safe location. Oil leaks from the lift pump, (including inlet and outlet lines), oil cooler housing (including drains, inlet and outlet lines), gages (drain, fill, and level), oil cooler tube, and motor shaft oil dam are collected by the system. The system consists of sealed metal pans and covers with drains to a 150-gallon collection tank in the basement for each pair of pumps.

The postulated oil fire could not propagate to any of the cable trays on the basement level. The instrumentation cables attached to the primary coolant pipes near the pump are enclosed in conduit. Damage to these cables would not prevent safe shutdown.

Postulated Fire B: (Ground level) A cable tray fire is assumed to occur in a cable tray at section 20c on the ground level. This location is selected because of the large number of cable trays at this location.

All cable runs in the containment meet the separation criteria except where an exemption from 10 CFR 50 Appendix R Section III. G. has been granted or radiant energy shields installed. Since the only significant combustibles on this level are the cables a fire was postulated at a high density region of cable trays along the eastern perimeter of the containment structure. Assuming total involvement of the six cable trays (two of which are separated by 3 feet from the other four), the maximum consequences would be the loss of several safety related division D cables. This would not prevent safe shutdown since redundant divisions A,B and C are available.

Postulated Fire C: (operating level) A fire is postulated in the central rack of filters (one half of the total) located in containment ventilation equipment VA-6A and VA-6B.

The primary source of combustibles on the operating level are the charcoal filters. The postulated fire may spread from the initial location to a maximum of one-half of the total filters. The filter fire in itself would cause no damage to safety related equipment, other than the ventilation system. A charcoal fire is relatively isolated by the structure of the filter assembly. There are dampers, mist extractors, and absolute filters in front of the charcoal filters. After the filters there is a long section of ventilation ducting leading to the ventilation fans. These features can be expected to contain the charcoal fire in the filter assembly.

No safety related cable trays are at this elevation. This postulated fire would not prevent safe shutdown, nor cause radio-activity release outside the containment.

Fire Suppression Effects

No automatic fire suppression systems are installed in Fire Area 30. Failure or inadvertent operation of a water system or use of manual hose would represent a potential source of chlorides and other impurities which could initiate or promote corrosive attack of the reactor coolant system pressure boundary. Aside from these factors, release of water in Fire Area 30 would have no effects worse than the design-basis fire.

As previously discussed, the RCP's have installed oil leak collection systems. Any water released in this fire area would flow to a pump in the lowest level of containment, from which it could be pumped out as conditions allow.

Applicable References

SER Section 5.20
Safe Shutdown Cable Separation Analysis (Rev. 0 - September 28, 1978)
OPPD Reactor Coolant Pump Lube Oil Collection Preliminary Design (June 6, 1979)
Fort Calhoun Fire Protection Review, telecopied from the NRC to OPPD on April 16, 1980.
NRC Amendment No. 53 to Facility Operating License No. DPR-40 (Supplement to SER)
Letter from NRC to OPPD granting exemptions (July 3, 1985)
Safety Evaluation by the NRC related to Appendix R Modifications (July 1, 1986)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

December 20, 1988

III.0 SER

88-457

Docket No. 50-285

Mr. Kenneth J. Morris
Division Manager - Nuclear Operations
Omaha Public Power District
1623 Harney Street
Omaha, Nebraska 68102

Dear Mr. Morris:

SUBJECT: FORT CALHOUN STATION, UNIT 1 - EXEMPTION FROM THE REQUIREMENTS OF APPENDIX R TO 10 CFR PART 50 (SECTION 111.0)

The Commission has issued the enclosed exemption from the fire protection requirements of Appendix R, Section III.0, to 10 CFR Part 50 for the Fort Calhoun Station, Unit 1. This section requires that the reactor coolant pump (RCP) oil collection system be capable of collecting lube oil from all pressurized and unpressurized leakage sites in the RCP lube oil system and that the leakage shall be collected in a vented enclosed container capable of holding the entire lube oil system inventory.

By letter dated November 28, 1988, Omaha Public Power District (OPPD) requested approval of an exemption from the technical requirements of Section III.0 of Appendix R to 10 CFR Part 50 in that the installed lube oil holdup tank capacity is 150 gallons, based on a maximum expected leak from a single failure, rather than a two pump inventory of 280 gallons.

Based on the staff's review and evaluation of the request, the Commission has determined that the RCP lube oil collection system provides an equivalent level of safety to that achieved by compliance with Appendix R. Therefore, the exemption request as described in the enclosed Exemption has been granted. Our Safety Evaluation is also enclosed.

DD WCJ, MOG, RLA, KJM, KCH, RCK, JJF, JMW, JBK, BRH, RB, DJM, FILE, JRG, DKD, BC, RKB, JS, RCD, JM, LLZ, KET, RGE, CFS, SARC, RDP, HMT, PRB, JGK, RRL, FCS 12/30/88

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A copy of the "Environmental Assessment and Finding of No Significant Impact" was sent to you by letter dated December 13, 1988, and published in the Federal Register on December 20, 1988 (53 FR51174).

The Exemption is being filed with the Office of the Federal Register for publication.

Sincerely,

José A. Calvo

Jose A. Calvo, Director
Project Directorate IV
Division of Reactor Projects - III,
IV, V and Special Projects
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc w/enclosure:
See next page

cc:
Harry H. Voigt, Esq.
LeBoeuf, Lamb, Leiby & MacRae
1333 New Hampshire Avenue, NW
Washington, D.C. 20036

Mr. Jack Jensen, Chairman
Washington County Board
of Supervisors
Blair, Nebraska 68008

Mr. Phillip Harrell, Resident Inspector
U.S. Nuclear Regulatory Commission
P. O. Box 309
Fort Calhoun, Nebraska 68023

Mr. Charles B. Brinkman, Manager
Washington Nuclear Operations
C-E Power Systems
7910 Woodmont Avenue
Bethesda, Maryland 20814

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
Office of Executive Director
for Operations
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

Harold Borchert, Director
Division of Radiological Health
Department of Health
301 Centennial Mall, South
P.O. Box 95007
Lincoln, Nebraska 68509

W. G. Gates, Manager
Fort Calhoun Station
P. O. Box 399
Fort Calhoun, Nebraska 68023

7590-01

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
Omaha Public Power District	)	Docket No. 50-285
(Fort Calhoun Station, Unit 1)	)	

EXEMPTION

I.

Omaha Public Power District (OPPD or the licensee) is the holder of Facility Operating License No. DPR-40 which authorizes the operation of Fort Calhoun Station, Unit 1 (the facility), at a steady state power level not in excess of 1500 megawatts thermal. The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (the Commission or the staff) now or hereafter in effect. The facility is a pressurized water reactor (PWR) located at the licensee's site in Washington County, Nebraska.

II.

10 CFR 50.48, "Fire Protection", and Appendix R to 10 CFR Part 50, "Fire Protection Program for Nuclear Facilities Operating Prior to January 1, 1979" set forth certain fire protection features required to satisfy the General Design Criterion related to fire protection (Criterion 3, Appendix A to 10 CFR Part 50).

Section III.O of Appendix R requires that facilities have a reactor coolant pump oil collection system if the containment is not inerted during normal operation. This system must be designed, engineered, and installed so that failure during normal or design basis accident conditions will not lead to fire, and that there is reasonable assurance that the system will withstand a Safe Shutdown Earthquake. Additionally, the system must drain to a vented closed container that can hold the entire lube oil system inventory.

III.

By letter dated November 28, 1988, the licensee requested approval of an exemption from Appendix R, Section III.O to the extent that it requires the installation of a reactor coolant pump (RCP) oil collection system sized to accommodate the entire lube oil system inventory.

Exemption Requested

The licensee requested an exemption from the specific requirements of Section III.O that would require the reactor coolant pump oil collection system drain tank capacity to be capable of containing the entire reactor coolant pump lube oil inventory.

The licensee stated in a letter dated November 28, 1988 that the reactor coolant pump oil collection system capacity was designed such that oil leaks from the RCP lift pumps, oil coolers, flanged or gasketed oil connections, oil sight glasses, drain and fill connection points, and oil reservoir points would be contained. The system consists of sealed pans and covers enclosing the pressurized oil containing portions of each RCP and drain piping routed to one of two 150 gallon collection tanks. One tank is associated with each pair of

RCPs. The collection tank capacity was based on a maximum expected leak of 110 gallons for any single failure as opposed to a two pump inventory of 280 gallons for each tank.

IV.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12, this Exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. The Commission has further determined that special circumstances, as set forth in 10 CFR 50.12(a)(2)(ii), are present justifying the Exemption, namely that the application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. In general, the underlying purpose of the rule is to accomplish safe shutdown in the event of a single fire and maintain the plant in a safe condition. Under a worst case scenario, reactor coolant pump lube oil would overflow from the collection tanks, due to the limited storage capacity, and will be channeled to the floor drains. Since no ignition sources are present in the area, no fire is likely to occur. Therefore, the limited lube oil collection system capacity does not pose a significant hazard to safe shutdown systems. Further, the Fort Calhoun Station Fire Hazards Analysis has evaluated the effect of a lube oil fire in the reactor coolant pump cavities and has shown that sufficient undamaged equipment would remain available to support safe shutdown.

Accordingly, the Commission hereby grants the exemption from the requirements of 10 CFR 50, Appendix R, as described in Section III above.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this Exemption will have no significant impact on the environment (53 FR 51174).

The Safety Evaluation concurrently issued and related to this action and the above referenced submittals by the licensee are available for public inspection at the Commission's Public Document Room, 2120 L Street, N.W., Washington, D.C., and at the local public document room located at the W. Dale Clark Library. 215 South 15th Street, Omaha, Nebraska 68102.

This Exemption is effective upon issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Gary M. Holahan

Gary M. Holahan, Acting Director
Division of Reactor Projects - III,
IV, V and Special Projects
Office of Nuclear Reactor Regulation

Dated at Rockville, Maryland
this 20th day of December, 1988

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

EVALUATION OF FIRE PROTECTION EXEMPTION REQUEST

FACILITY OPERATING LICENSE NO. DPR-40

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION, UNIT 1

DOCKET NO. 50-285

1.0 INTRODUCTION

By letter dated November 28, 1988, the licensee requested approval of an exemption from the technical requirements of Section III.O. of Appendix R to 10 CFR Part 50 to the extent that it requires the installation of a reactor coolant pump (RCP) oil collection system sized to accommodate the entire lube oil system inventory.

2.0 DISCUSSION

Each of the four reactor coolant pumps at Fort Calhoun Station contain 140 gallons of lube oil. The lube oil collection system is designed to contain oil leaks from the lift pumps, oil coolers, flanged or gasketed oil connections, oil level sight glasses, drain and fill connection points, and oil reservoirs. The system consists of three sealed pans and covers that enclose the pressurized oil containing components of each reactor coolant pump with a two inch drain line routed to one of the two 150 gallon collection tanks, one for each pair of reactor coolant pumps. The collection tank capacity is based on a maximum expected leak of 110 gallons for any single failure as opposed to a total system inventory of 280 gallons for each tank.

Each horizontally positioned tank is equipped with an overflow drain located at the top of the tank which drains to the floor. The tanks are located between and below the reactor coolant pump cavities at basement elevation 994 ft. approximately 23 ft. below the collection pans. Assuming a simultaneous failure of all four lubricating oil systems, the entire inventory of oil is assumed to be discharged to the collection system. This would result in a maximum of 130 gallons of lube oil overflowing onto the containment basement floor at each tank location from the overflow drains and into the nearest 4 inch floor drain. The basement floor in the area of each tank is sloped to the nearest floor drain, which is within 12 feet of the collection tank for reactor coolant pumps RC-3C and RC-3D, and within 4 feet of the collection tank for pumps RC-3A and RC-3B. In each area oil would temporarily pool and would be contained by the floor drain.

The licensee conducted a walkdown of the area to determine if any potential ignition sources are located in the vicinity of the tanks and floor drains. Based on the results of this walkdown, no potential ignition sources were identified at or below the level of the tank.

The licensee justified the exemption on the basis of the design of the existing lube oil system and the absence of sources of ignition in the area where potential lube oil overflow would occur.

3.0 EVALUATION

The technical requirements of Section III.O of Appendix R to 10 CFR Part 50 are not met because the existing oil collection system is not designed to hold the lube oil inventory from all four of the reactor coolant pumps.

The staff initially had several concerns with the existing system. The first was that during a seismic event, the lube oil collection system might lose its integrity, resulting in oil leaking onto hot surfaces and causing a fire. The licensee, however, affirmed in the November 28, 1988 letter that the system was designed to survive a safe shutdown earthquake (SSE) with its leak integrity intact.

The staff was also concerned that all unpressurized leakage points were not encompassed by the oil collection system. The licensee indicated that oil piping that is unpressurized is either internal to the reactor coolant pump (RCP) motor bearing assembly or qualified to withstand the elevated pressures anticipated during a seismic event.

The staff was also concerned that there may be hot surfaces or other potential sources of ignition in proximity to where lube oil overflow would likely occur. The licensee affirmed that on the basis of a walkdown of the system, no such ignition sources exist in the vicinity of the tanks and four drains.

Under the worse-case scenario, lube oil will drain into the two holding tanks. Because of the limited storage capacity, the oil will overflow onto the floor and will be channeled to the floor drains. Since no ignition sources are present in the area, no fire is likely to occur. The staff, therefore, agrees with the licensee's analysis that the pumps do not pose a significant hazard to safe shutdown systems.

4.0 CONCLUSION

Based on the above evaluation, the staff concludes that the existing RCP lube oil collection system provides an equivalent level of safety to that achieved by compliance with the requirement of Section III.O of Appendix R to 10 CFR Part 50. Therefore, the licensee's request for exemption should be granted.

Dated: December 20, 1988
Principle Contributor: D. Kubicki

10CFR50, APPENDIX R, SECTION III.O

WHITE PAPER REVIEW

August 9, 1996
(Revision 1, 2/6/97)

Issue Statement

While performing a fire protection interaction review for MR-95-022, RCP Motor Replacement, existing FP license basis documents were examined for impact. SER (LIC88-0457, dated 12/20/88) regarding an exemption to 10CFR50, Appendix R, Section III.O (RCP Lube Oil Collection) appears to contain an error. An excerpt from section 3.0 of the Safety Evaluation reads:

> "The licensee indicated that oil piping that is unpressurized is either internal to the reactor coolant pump (RCP) motor bearing assembly or qualified to withstand the elevated pressures anticipated during a seismic event."

This appears to be a read back combination of OPPD responses to Staff concerns regarding the exemption request. The purpose of this document is to determine the current status of RCP Lube Oil design basis and any impacts due to MR-95-022.

Scope

This document will be limited to the following:

- investigate and summarize the original RCP Lube Oil Collection configuration
- summarize the current design basis on the existing RCP's
- evaluate MR-95-022 impacts to the existing configuration/exemption basis
- recommend a course of action regarding 10CFR50, Appendix R section III.O
  -existing design basis
  -MR-95-022 impacts

Actions Taken

Reference Documents Reviewed:

1) 10CFR50, Appendix R, Section III.O
2) Original FP Program Submittal, LIC-76-0180, dated 12/31/76
3) Original Program SER, LIC-78-0104, dated 8/23/78
4) Design Package Submittal, LIC-79-0059, dated 6/6/79
5) NRC Triennial Inspection Report, LIC-88-880, dated 9/23/88
6) OPPD Exemption Request, LIC-88-1066, dated 11/28/88
7) NRC Exemption to Appendix R, III.O, LIC88-457, dated 12/20/88
8) MR-95-022, "Reactor Coolant Pump Motor Replacement"

Discussion

RCP motor lube oil collection requirements date back at least to the NRC's Fire Protection Guidelines of Appendix A to APCSB 9.5-1 (1976). OPPD's original FP program submittal (12/31/76) acknowledges RCP lube oil as a 'major combustible'. The submittal goes on to evaluate a 15 minute fire burn in Containment resulting from the combustion of the total inventory of lube oil from one RCP (150 gal.). The evaluation concludes that a burn of this magnitude would not jeopardize safe shutdown. This evaluation is referenced by OPPD as meeting the Appendix A, 'Control of Combustibles' mandate [per section D.2(a)].

The SER granted to OPPD in regard to the 1976 submittal, dated 8/23/78, lists the RCP Lube Oil Collection System as an 'Incomplete Item'. The SER went on to document that OPPD committed to respond to the issue by June 1979. It is assumed that correspondence between OPPD and the NRC took place between the 1976 submittal and the 1978 SER. Documentation of this communication has not been retrieved.

OPPD submitted a Final Design Package of MR-78-057, "RC Pump Lube Oil Collection" to the NRC 6/6/79 (LIC-79-0059). The key passage in this submittal is as follows:

> "The lower oil reservoir is not being collected since it contains only four (4) gallons, has an internal oil cooler and there are no pressurized lines, sight glasses, etc. Also, the oil level transmitter is not contained since the transmitter housing has a pressure rating of 500 psig and it is only exposed to 17 inches of oil.".

The cover letter to this submittal indicates the NRC was to review and approve the modification prior to installation. The NRC documented acceptance of this configuration in Amendment # 53 to the FCS license dated 11/17/80.

The RCP Lube Oil Collection System was again reviewed by the NRC in 1988 during a triennial FP inspection. The results of this inspection (LIC-88-880) once again listed the oil collection system as an "unresolved item". The following excerpt was taken from Section 4. of the report:

> "Since the oil collection system, including collection pans, drain lines, and collection tanks has enough capacity to hold all of the oil from the pumps, there appears to not be a safety concern. However, the present system does not comply with Section III.O of Appendix R and an exemption is required."

OPPD filed an exemption request with the NRC 11/28/88 (LIC-88-1066). Attachment 2 to the exemption request responded to three questions raised during a phone conversation held 11/25/88. The third question/answer is as follows:

> "OPPD states that the system will contain oil from pressurized points. What about unpressurized points?
>
> Answer
> The oil piping that is unpressurized is either internal to the motor bearing assembly or of such a high pressure rating that oil leakage is not considered a credible event. The total volume of the unpressurized oil system in the lower bearing assembly is only four gallons per pump. The entire upper bearing assembly is provided with collection capacity with the exception of the level transmitters which are rated at 500 psig."

It should be noted that question # 2 regarded seismic design capability of the collection system. The responding NRC exemption SER contained the read back error as discussed in the introduction of this document.

Evaluation

Key Points

- RCP Oil Collection System installed per MR-78-057 was reviewed and approved by the NRC
- NRC Appendix R audit report categorized the FCS RCP oil collection system configuration deviations as 'not safety significant'
- The new pump has a larger lower bearing lube oil reservoir (11 gallons vs 4 gallons).
- The new pump contains less lube oil (total) than existing pumps.
- The new pump configuration has a sight glass on the lower motor bearing reservoir.

Conclusions

1) The existing SER on the RCP lube oil contains a misstatement that should be corrected.
2) The new pump motor lube oil system differs in capacity and fittings (sight glass) from the current exempted configuration.

Recommendations

- removal of the new motor lower bearing sight glass if possible to more closely emulate the existing pump configuration and verify fill/drain piping and level transmitter as equivalent

  Currently, OPPD is not planning on removing the sight glasses.

- perform FP evaluation regarding the remaining configuration differences as "insignificant"

  The fire protection evaluation for the remaining configuration differences are addressed in Attachment 9, Section 3 "Fire Protection Evaluation" of LIC-97-015, Letter to NRC from OPPD (S. K. Gambhir) dated February 7, 1997.

  The evaluation shows that the lube oil capacity of the new RCP-3B pump motor will not place OPPD outside the bounds of previous fire hazard analysis.

- conduct NRC notification of configuration change (including documentation as not fire safety significant) and request clarification/update of the SER

  This information is documented in LIC-97-015, Letter to NRC from OPPD (S. K. Gambhir) dated February 7, 1997.

Ken Erdman
Nuclear Design Engineer

DATE: December 12, 1996

FROM: K. A. Erdman

SUBJECT: CID960584/01, "Reactor Coolant Pump Motor Replacement Modification MRFC95-022"

REFERENCE: 1) OPPD Memo, Matthews to Van Sant, dated August 30, 1996 (LIM-96-0124)
2) OPPD Memo, Van Sant to Tills, dated August 13,1996 (PED-DEN-96-0383)
3) White Paper Review of 10CFR50, Appendix R, Sec. IIIO, dated August 9, 1996

ASSUMPTIONS: As stated throughout the document.

Task Description

The stated task of the subject CID is as follows:

> "Provide updated description, 50.59, and assessment of RCP motor replacement and fire protection aspects regarding MR95-022 for NRC."

Resolution of this task will be performed in the following activities:

Section 1 Establish RCP Lube Oil Collection Design/License Basis
Section 2 Document MR95-022 FP Related Configuration Changes
Section 3 Fire Protection Evaluation of MR95-022 Activities
Section 4 Document FP Impact Acceptability per 10CFR50.59
Section 5 Document Revisions for NRC/FP Program

SECTION 1 Establish RCP Motor Lube Oil Collection System Design/License Basis

Reference Documents:

1) 10CFR50, Appendix R, Section III.O
2) OPPD Fire Protection Program Submittal, LIC-76-0180, dated 12/31/76
3) Program SER, LIC-78-0104, dated 8/23/78
4) RCP Lube Oil Design Package, NRC Submittal, LIC-79-0059, dated 6/6/79
5) NRC Triennial Inspection Report, LIC-88-880, dated 9/23/88
6) OPPD Exemption Request, LIC-88-1066, dated 11/28/88
7) NRC Exemption to Appendix R, III.O, LIC88-457, dated 12/20/88

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8) USAR Section 9.11, "Fire Protection"
9) MR-95-022, "Reactor Coolant Pump Motor Replacement"

Discussion

RCP motor lube oil collection requirements date back to the NRC's Fire Protection Guidelines of Appendix A to APCSB 9.5-1 (1976). OPPD's original FP program submittal (12/31/76) acknowledges RCP lube oil as a 'major combustible'. The submittal goes on to evaluate a 15 minute fire burn in Containment resulting from combustion of the total lube oil inventory from one RCP motor (150 gallons was used for the appraisal). The evaluation concludes that a burn of this magnitude spread throughout a steam generator bay would not prevent safe shutdown of the Plant. This evaluation is referenced by OPPD as meeting the Appendix A, 'Control of Combustibles' mandate [per section D.2(a)] without a RCP motor lube oil collection system.

The SER granted to OPPD in regard to the above submittal, dated 8/23/78, lists the RCP Lube Oil Collection System as an 'Incomplete Item'. The SER went on to document that OPPD committed to respond to the issue by June 1979. It is assumed that additional correspondence between OPPD and the NRC took place between the 1976 submittal and the 1978 SER. Documentation of this communication has not been retrieved.

OPPD submitted a Final Design Package of MR-78-057, "RC Pump Lube Oil Collection" to the NRC 6/6/79 (LIC-79-0059) for review and approval prior to construction. A key passage in this submittal is as follows:

> "The lower oil reservoir is not being collected since it contains only four (4) gallons, has an internal oil cooler and there are no pressurized lines, sight glasses, etc. Also, the oil level transmitter is not contained since the transmitter housing has a pressure rating of 500 psig and it is only exposed to 17 inches of oil.".

The modification package submittal documented design basis of the lube oil collection system. NRC staff documented acceptance of the proposed configuration in Amendment #53 to the FCS Operating License dated 11/17/80.

The RCP Lube Oil Collection System was again reviewed by the NRC in 1988 during a triennial FP inspection. The results of this inspection (LIC-88-880) once again listed the oil collection system as an 'unresolved item'. The following excerpt was taken from Section 4. of the report:

> "Since the oil collection system, including collection pans,

drain lines, and collection tanks has enough capacity to hold all of the oil from the pumps, there appears to not be a safety concern. However, the present system does not comply with Section III.O of Appendix R and an exemption is required."

OPPD filed an exemption request with the NRC 11/28/88 (LIC-88-1066). The exemption request contained resolution to three questions asked by the NRC during a follow up phone call after the inspection. An SER was issued to OPPD granting the exemption to Appendix R 12/20/88.

Conclusions

RCP Motor Lube Oil License Basis (Various Correspondence since 1978)

- RCP Oil Collection System installed per MR-78-057 was reviewed and approved by the NRC
- NRC Appendix R audit report categorized the FCS RCP oil collection system configuration deviations as 'not safety significant'
- Containment has been analyzed for a 150 gallon lube oil fire in the RCP/Steam Generator Cavity and found not to impact SSD

RCP Lube Oil Design Basis (Per Submitted Modification Package FC78-057)

- Pressurized components (upper) reservoir is totally enclosed in 'leak resistant' pans
- 1000 PSI oil leak is evaluated for retention in collection system
- Lower bearing reservoir does not require collection due to no credible leak points external to the motor
- 110 gallons is the worst case single failure RCP motor lube oil failure

Current Exemptions to 10CFR50, App. R III.0 as follows (OPPD submittal and subsequent Exemption SER):

- Capacity of drain tank is based on maximum single failure (upper reservoir) leak rather than the full lube oil inventory of two RCP motors (two RCP's drain to each tank)
- Collection/Drain system is seismically mounted (per response to questions in attachment 2 to exemption request)
- RCP Oil collection system on GE motors is equivalent to Appendix R III.0

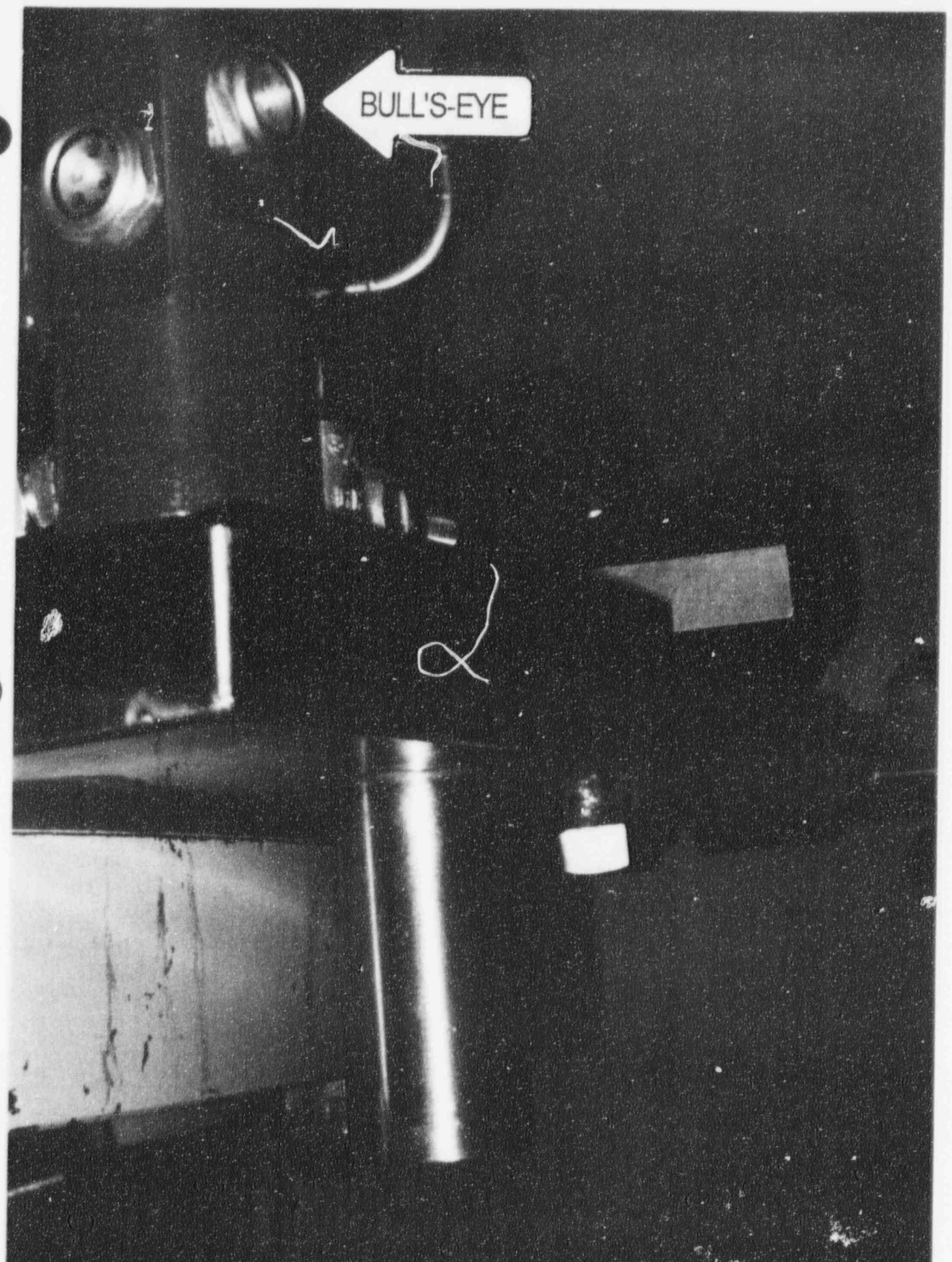
SECTION 2 MR95-022, "RCP-3B Motor Replacement", FP Related Configuration Changes

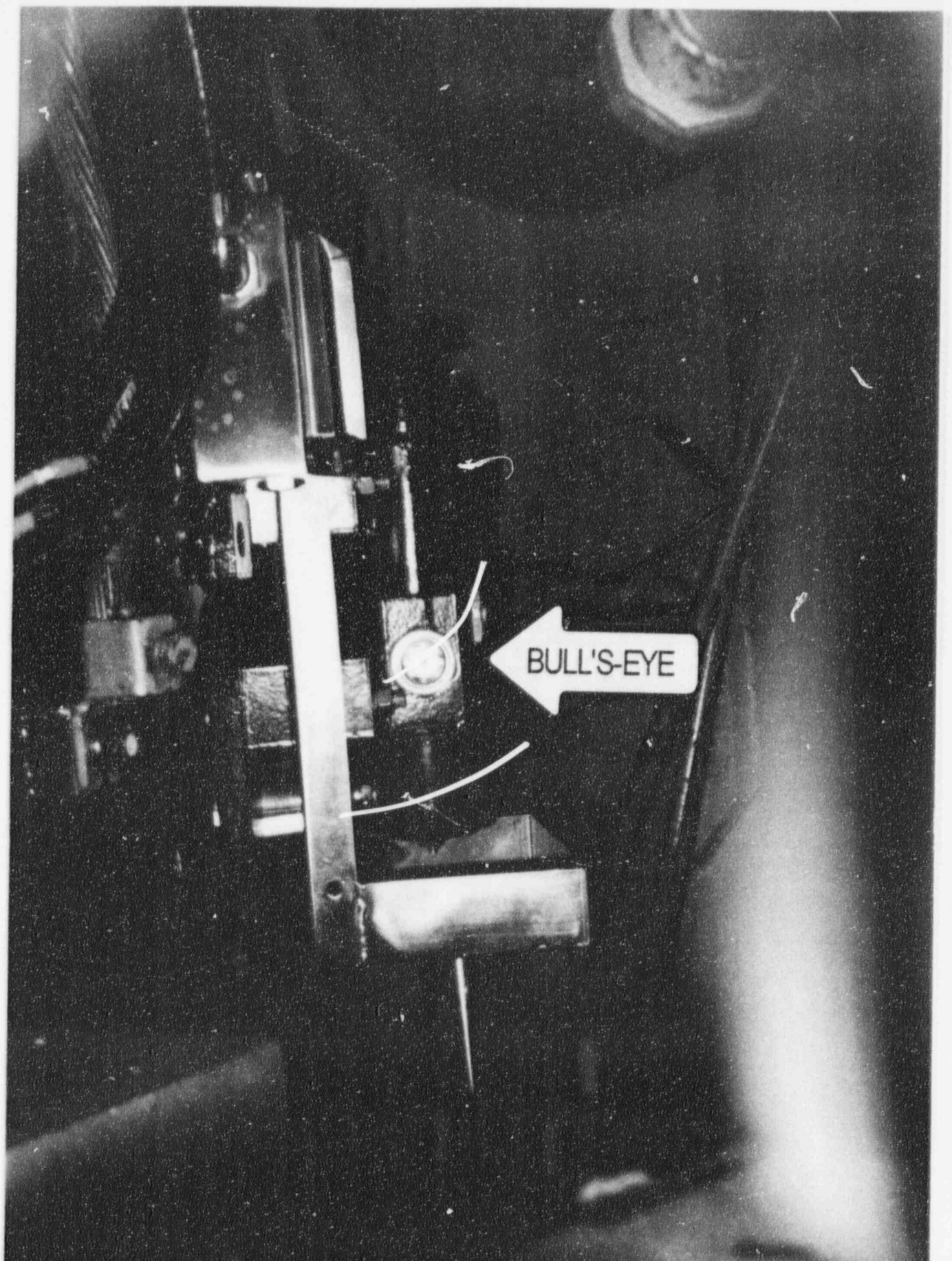
The new reactor coolant pump, RC-3B, motor was installed during the 1996 refueling outage. The motor, Squirrel Cage Motor QOVG 900 FA 6, was manufactured by ABB Industries in Switzerland. The new motor lube oil collection system is designed to be equivalent to the existing GE motor lube oil collection system. Design differences between the ABB and GE motors are outlined below.

Description	ABB Motor - New	GE Motor - Existing	Remarks
Upper lube oil cooler	The upper lube oil cooler is built inside the motor housing. References: HTAM125322, R D	The upper lube oil cooler is located outside the motor housing. References: 791E610, R 9	The new motor lube oil cooler design is superior in terms of reducing the amount of external piping that contains oil. External piping is piping that is located outside the motor housing which could potentially leak oil. The reduction in external oil piping reduces potential oil leak points. Superior.
Oil lift pump(s) for upper lube oil system	The new motor has one oil lift pump for the guide and thrust bearings, and anti-reverse rotation device (ARRD). The pump is turned on when the motor speed is 90% or less. At full operating speed, the oil lift pump is shutoff. The nominal pump flow rate is 2.55 gpm. References: Dwg.HTAM327980, R A Calc. FC06596, R 0	The existing motor has high and low pressure oil lift pumps. The low pressure pump is on when the motor is running and supplies oil to the ARRD. The high pressure oil lift pump is turned on when the motor speed is 90% or less. The combined flow rate of both pump is 1.3 gpm. References: Dwg. 115D7604, R 1	The new motor oil lift pump is in operation only during the RC pump startup and shutdown. Therefore, there is no pressurized oil piping when the motor is running at full speed. Existing motor has about 0.6 gpm flowing to the ARRD when the motor is running. Superior.

Description	ABB Motor - New	GE Motor - Existing	Remarks
Upper lube oil instruments	Oil level alarm and transmitter, flow and pressure switches are provided. References: Dwg. HTAM242833, R F HTAM125322, R D HTAM125322L, R D	Oil level alarm and transmitter, flow and pressure switches are provided. References: Dwg. 115D7590, R 7 Vendor Manual TM F180.0570	Instruments may be different but both motors have the same level of alarm, transmitter, and flow detection capabilities.
Upper lube oil collection and drain system	The oil lift pump, piping, oil level indicator, fill/drain, and oil level transmitter piping external to the motor are enclosed in two collection enclosures. The oil collection enclosures are connected to the existing oil drain system. The side and upper panels are not oil tight but they are designed and constructed to contain leaks from pressurized oil lines and drain to the oil collection system. The oil level indicator, fill and drain, and oil level transmitter piping are only subject to the pressure head of the oil level in the reservoir. The oil enclosure panels are made of 2 mm thick or 0.079" stainless steel panels and are designed to maintain structural integrity during a design basis earthquake. References: Dwg: HTAM242884,Sht1, RA HTAM242884,Sht2, RA Calc. FC06606, R 1A	The oil lift pumps, piping, oil level indicator, fill/drain, and oil level transmitter piping external to the motor are enclosed in three collection enclosures and are drained to retention tanks. The top enclosures are not leak tight but they are designed and constructed so that oil spray will be contained. The enclosure panels are made of 16 gauge (0.06" thick) stainless steel panels and are designed to maintain structural integrity during a design basis earthquake. References: MR-FC-78-057 NUS Dwgs file # Dwg. For RC-3A 001689 1928-M-037 001690 1928-M-036 001691 1928-M-035 001694 1928-M-032 001695 1928-M-031 001696 1928-M-030 001699 1928-M-025 001707 1928-M-015	The new motor upper lube oil system is simpler in design and has significantly less piping and joints that could potentially leak outside the motor housing. The new motor upper lube oil collection system is designed to maintain structural integrity during a design basis earthquake, each enclosure has a 1 3/4" diameter drain tied to a 2" existing lube oil drain system. The existing oil drain system is a closed system consisting of piping, flexible hose and a vented collection tank. Equivalent.

Description	ABB Motor - New	GE Motor - Existing	Remarks
Lower lube oil system and instruments	The lower bearing lube oil reservoir has a fill/drain, oil level indicator, vent, and oil level transmitter external to the motor housing. The fill/drain and level indicator are inter-connected and can be considered a single unit. The reservoir has a 11.6 gallon capacity. Oil piping and instruments external to the motor are not provided with an collection/drain system based on the following; 1.)Oil piping is un-pressurized (no pumps). 2.)The oil fill and drain is made from carbon steel bar stock and has three 1" diameter glass "Bulls Eye's" for oil level indication. Each "Bulls Eye's" is rated at 256°F @23 psi. The fill/drain and level indicator unit is attached to the motor housing by four 12 mm or 0.47" diameter bolts. 3.)The Rosemount oil level trans-mitter has a pressure limit of 2000 psig. 4.)The oil level indicator and transmitter are designed to main-tain structural integrity during a design basis earthquake.	The lower bearing oil reservoir has the same basic components such as the fill/drain, level indicator, and oil level transmitter. The oil cooler is inside the motor housing and requires 4 gallons of oil. The oil level indicator does not have "Bulls Eye's" as with the new motor. The oil level is checked by opening the level indicator top cover. The Foxboro oil level transmitter has a pressure rating of 500 psig. References: Dwgs. 115D7590, Rev 7 791E610, Rev 9	The new and existing motor oil cooler, oil piping and instruments are basically the same. The new motor oil level indicator has three 1" diameter "Bulls Eye's" for oil level reading. The "Bull's Eyes" have no load bearing surfaces. The new motor oil level indicator unit is conservatively designed in terms of construction and mounting. Based on the design and construction of the lower lube oil piping and instrumentation, it is concluded that probability of an oil leak is remote for both the new and existing motor. Equivalent.


BULL'S-EYE


BULL'S-EYE

RCP Motor Lube Oil System Statistic Comparison

Lube Oil System	ABB (NEW)	GE (OLD)
Lube Oil Type	Mobil SHC-626	Mobil
Upper Res.	Both	DTE Heavy-Medium
Lower Res.		DTE #797
Capacity (GAL)	82.4	115
Upper Res.	70.8	111
Lower Res.	11.6	4
Operating Press.		
Upper Res.	1500PSI*/2.5GPM	950PSI*/1.3GPM
Lower Res.	0 PSI	0 PSI
Oil Level Indicator		
Upper Res.	Yes	Yes
Lower Res.	Yes	No

* Rated Discharge Pressure of the Lift Pump

SECTION 3 Fire Protection Evaluation

Assumptions:

Original Evaluation

- "Maximum Expected Leak" = 110 gallons (Exemption Submittal LIC-88-1066) - Assume this is derived from the upper reservoir capacity of approximately 111 gallons
- The 15 minute fire discussed in the 1976 program submittal is based on:
  1) 150 Gallon of Lubricant
  2) 155,000 BTU/Gallon combustible load for lubricant
  3) 80,000 BTU/FT^2 loading equates to a 60 minute fire

NOTE: The combustible load and burn time factor listed above are from the combustible loading analysis, FC05814.

I. Verify original postulated fire site to establish estimated combustion time calculation parameter.

Given: A 1 HR Fire involving 150 gallons of oil @ 155 kBTU/Gal.

Therefore the fire site would be limited by the following expression: $1\ Hr = \left[\frac{150\ Gal \times 155{,}000\ BTU(FT)/Gal}{80{,}000\ BTU/Ft(Hr)} \right] = (X)Ft^2$

A 1 hour fire site would be approximately = 291 Ft^2

This implies a 15 minute burn site would be 4 X 290 = 1165 FT^2.

This fire site corresponds to the steam generator bay floor area (ref. Drwg. S-18,19, and M-14) and is reasonable.

II. Check Impact of Lower Reservoir Contribution.

Given: Using the above fire model, the lower reservoir (4 gallons) burn time contribution is less than .4 minutes ➡ TRIVIAL.

III. MR95-022 Evaluation

Maximum new motor (ABB) burn due to single failure (i.e. upper reservoir inventory only):

$$\text{Burn Time(hr)} = \left[\frac{71 \times 155{,}000}{1165 \times 80{,}000} \right] = .12(Hr) = 7 \text{ minutes}$$

Burn Time of lower reservoir (11.6 gallon) = 1.2 minutes

Burn time estimate of new motor is enveloped by existing motors.

Comparative Fire Hazard of the New Pump Motor

- The new RCP motor configuration is within the postulated design basis fire burn time submitted and approved by the NRC.

- Baseline RCP Fire Hazard Analysis per the original FP program submittal (Ref. Fire Protection Program Submittal LIC-76-0180) is still valid since the postulated fire duration of the new motor configuration is less than originally evaluated.

The data used in original analysis is based on 150 gallon RCP lube oil inventory. The new pump is nominal 82.4 gallon. Therefore the fire loading is less than before → OK.

The lube oil collection system is similar in design to the old system as follows:

- collection system uses component enclosures which will catch and drain pressurized leaks

- entirely encapsulate external, pressurized oil system components.

- the collection system will survive DBD seismic events intact

- the system is drained to an existing retention tank remote from ignition sources

The new RCP motor lower bearing lube oil reservoir is not pressurized and therefore is not a credible leak path (same as existing pumps). The new pump reservoir is larger than the existing pumps (11.6 gallon vs 4 gallon). However, since the lower reservoir does not present a viable leak path no additional fire hazard is considered.

Conclusions

1) Existing License Basis for SSD fire in Containment is not challenged by the modification. FCS Station maintains the ability to be safely shutdown in the event of a design basis fire.

2) The new pump motor lube oil system as evaluated in section 2 does not present an additional fire hazard.

SECTION 4 10CFR50.59 SAFETY EVALUATION

Fire Protection Safe Shutdown is not impacted by MR95-022, "RCP-3B Motor Replacement". 10CFR50.59 did not involve an unreviewed safety question.

SEE ATTACHED FORMS

SECTION 5 FP Document Reviews/Updates

Appendix R

- Exemption SER -
  SER (LIC88-0457, dated 12/20/88) regarding an exemption to 10CFR50, Appendix R, Section III.O (RCP Lube Oil Collection) appears to contain an error. An excerpt from section 3.0 of the Safety Evaluation reads:

  "The licensee indicated that oil piping that is unpressurized is either internal to the reactor coolant pump (RCP) motor bearing assembly or qualified to withstand the elevated pressures anticipated during a seismic event."

This appears to be a read back combination of OPPD responses to Staff concerns regarding the exemption request. This document should be resubmitted to update the NRC regarding the current status of RCP Lube Oil design basis due to MR-95-022.

- SSD Analysis EA89-055 - Appendix R III.O will be updated during the next revision to reflect the new configuration of RCP Lube Oil documentation post MR95-022. The lower combustible load in Fire Area 30 is trivial. Fire Area 30 analysis update is not required.

Fire Hazards Analysis

- Combustible Loading Calculation FC05814 - no markup is necessary. The change in combustible load is trivial.
- Compliance Matrix - update after receipt of new SER
- Fire Area 30 Evaluation - update with discussion on new ABB pump and general reference to DBD-115 discussion.

Design Basis Document DBD-115

- General discussion of the modification and impact activities post MR95-022.
- RCP Lube Oil Exemption - see above discussion.

USAR Section 9.11

- Update revision will be limited to listing the new SER when received, see section IV evaluation.

Fire protection Design Basis and Fire Protection Safe Shutdown are not degraded or placed in an unanalyzed configuration by MR95-022.

DEN-M recommends closure of this CID.

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ATTACH OR REFERENCE OTHER DOCUMENTS AS NECESSARY.

8.1 Activity Identification		
Procedure Change No.:	affecting Procedure:	
Modification Request No.: 95-022 Rev. 2 FDCR 96-0276	Design [X] Installation [ ] Testing [ ] (Check each phase of Mod. being evaluated)	
Temp Mod No.:	ECN No.:	Other:
Document Title: Reactor Coolant Pump Motor Replacement		

8.2 What (specifically) is being done?

Existing GE Reactor Coolant Pump (RCP), RC-3B, motor will be replaced with a motor manufactured by ABB Industries.

8.3 Why is this being done?

NOTE: PROVIDE AN ANSWER FOR EACH ITEM LISTED IN 8.2.

Tests performed by CHAR Services and GE indicated that RC-3B motor has the greatest potential for winding insulation failure and may cause significant plant downtime if the motor had to be replaced.

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8.4 Does the activity involve a change to the Technical Specifications other than the Basis Sections? If the Technical Specifications must be revised prior to performing this activity the answer is YES. Exit FC-154 and go to NOD-QP-7. If the activity meets the requirements of current Technical Specifications the answer is NO.	[ ] YES EXIT FC-154 **STOP GO TO NOD-QP-7**
The following Technical Specification Sections/Figures are applicable: 3.3, Table 3-6 The flywheel inspection frequency, RC-3B motor only, per RG 1.14 does not need to be updated in Technical Specifications for this modification. The initial flywheal inspection will be completed prior to motor installation.	[X] NO GO TO 8.5
8.5 Does the activity involve a change in the facility, procedures, tests, or experiments as described in the USAR? If the activity is inconsistent with the USAR and the USAR must be revised, the answer is YES. If the activity is not described in the USAR, OR the activity is consistent with or bounded by the USAR, and the USAR does not require a revision, the answer is NO.	[X] YES GO TO 8.6 **SECTION B REQUIRED**
The following USAR Sections/Figures are applicable: 4.3.5 Fig. 4.3-6, 4.3-13, 4.3-14 14.6.1 and 2 14.24	[ ] NO GO TO 8.6

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8.6	Does the activity conduct Tests or Experiments (STs, CPs and Special Procedures, etc.) not described in the USAR that could degrade the margins of safety during normal operation or anticipated transients; or could degrade the adequacy of structures, systems or components (SSC) to prevent accidents or mitigate accident conditions? If the activity could potentially degrade margins of safety or the adequacy of SSCs to prevent or mitigate accidents, the answer is YES. If the activity is not a test or experiment, OR the activity could not degrade margins of safety or the adequacy of SSCs to prevent or mitigate accidents, the answer is NO.	YES [ ] GO TO 8.7 SECTION B REQUIRED NO [X] GO TO 8.7
8.7	Could the activity adversely affect nuclear safety? CONSIDER SYSTEM INTERACTIONS AND JUSTIFY WHY THERE IS NO DEGRADATION OF ANY MARGIN OF SAFETY. Explain: The new motor will be of the same nominal dimensions, weight, and operational characteristics as the existing motor. The new motor will mount on the existing driver mount, and existing mechanical and electrical connections will be modified to fit the new motor. (2) The new motor is an acceptable replacement for the existing RCP motor, RC-3B. Continued on Attachment	YES [ ] GO TO 8.8 SECTION B REQUIRED NO [X] GO TO 8.8

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Section 8.7 continued.

The replacement motor basically has the same performance and features as the existing motor, Differences between the new and existing motor are discussed below.

Flywheel: The new motor flywheel is a single piece design made from forged ASTM A508 4/5 steel. The flywheel is shrink fit to an intermediate motor shaft sleeve and the sleeve is shrink fit to the journal of the motor. The flywheel meets the design ~~requirements~~ intent of Reg. Guide 1.14, R 1, Reactor Coolant Pump Flywheel Integrity. The lowest calculated critical fracture speed exceeds the calculated LOCA Overspeed, 3697 rpm, of the motor. Based on design, material, manufacturing, and pre-operational test performed at the factory, a flywheel failure is not a credible event and a flywheel shroud is not required. RG 1.14 does not require a shroud if the flywheel design, material quality, and inspections are adequately considered. R.G. 1.14 is used as a guidance document that specifies the necessary technical requirements to assure proper flywheel fuction. 2

Anti-Reverse Rotation Device (ARRD): The original ARRD is supplied by Formsprag and replacement by Ringspann. The basic components of ARRD such as sprags, inner and outer race are same. The new motor ARRD design does not require continuous oil supply and oil pump is stopped at approximately 90% of full speed. Oil lift pump supplies both the ARRD and bearings. The ARRD is designed to withstand the locked rotor torque of the motor with 100 % voltage applied in case of reverse phase rotation and the torque resulting from startup reverse flow.

Component Cooling Water (CCW): The combined CCW flow rate to both the upper and lower lube oil coolers and bypass piping is 39 gpm which is same as the existing motor. CCW piping/fitting attached to the motor is similar to existing motor. Minor piping changes and the use of 3" slip-on flanges over the weld neck flanges do not adversely affect seismic qualifications. The motor bearings are designed to continuously operate without cooling water for 3 to 5 minutes.

Oil Coolers: The new motor has the upper lube oil cooler built in to the motor and does not require a separate oil collection system. Current motor has external oil cooler and an oil collection system was built to comply with 10CFR50 Appendix R, Section III.O. The new motor lube oil pump, piping and instruments external to the motor will be provided with oil collection system similar to the existing motor. The new motor upper lube oil cooler oil capacity is approximately 71 gallons and the existing motor upper lube oil cooler and piping oil capacity is approximately 140 gallons.

Both the new and existing motors have the lower lube oil cooler, unpressurized, internal to the motor. The existing oil cooler contains 4 gallons of oil and the new motor oil cooler has 12 gallons. Since the oil cooler is internal to the motor, only the fill and drain piping and oil level instruments are sources of an oil leak. On current GE motor, the NRC has granted an exemption (LIC88-457, 12-20-88) to 10CFR50 Appendix R, Section III.O, I. e. having an oil collection system for external oil piping and oil level instruments that could potentially leak oil. The new motor lower lube oil cooler external piping and instruments are similar to the existing motor. Therefore, consequences of an oil leak for the new motor and existing motor are basically the same. A written evaluation of the new and existing lube oil system will be forwarded to the NRC.

In conclusion, both the new motor and existing motor are adequately designed to prevent fires due to oil leaks. See attached Section B "USQ Determination" for further discussion of system interaction analysis.

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ATTACH OR REFERENCE OTHER DOCUMENTS AS NECESSARY.

8.8 10 CFR 50.59 Applicability Screening Conclusion

IF ANY QUESTION (8.4-8.7) IS ANSWERED YES, THE ACTIVITY REQUIRES FURTHER EVALUTION. IF 8.4 (TECH SPEC CHANGE) IS ANSWERED YES FOLLOW NOD-QP-7. IF 8.5, 8.6, OR 8.7 IS ANSWERED YES, CONTINUE WITH FC-154 SECTION B. IF 8.4-8.7 ARE ALL ANSWERED NO, THE ACTIVITY IS NOT A 10 CFR 50.59 ACTIVITY.

[ ] This activity is not a 10 CFR 50.59 activity.

[X] This activity requires further evaluation, FC-154 Section B is required.

We hereby certify that this Screening is complete and accurate to the best of our knowledge.

DEPT. READER
R J Mueller 9/30/96
R MUELLER C513

Preparer (Print Name): Erick Jun	Extension: 6772
Signature: Erick Jun	Date: 9-19-96
Reviewer (Print Name): John C. Adams	Extension: 6844
Signature: John C Adams	Date: 9-20-96

Erick Jun — Preparer — 10-17-96 Date

FDCR 96-0186
1

J S Reed — Reviewer — FOR FDCR 96-0186 CHANGES ONLY — 10-18-96 Date

Erick Jun — Preparer — 11-12-96 Date

J K Connolley — Reviewer — 11/15/96 Date

2 Rev. 2 changes per FDCR 96-0276 EXJ 11-14-96

Reader
2 Alan W. Richard

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ATTACH OR REFERENCE OTHER DOCUMENTS AS NECESSARY.

9.1.1 Identify Plant Specific Design, Operating and Technical Documents (Write NONE if none identified)

Document Title	ID Number	Revision
Reactor Coolant Pumps	USAR 4.3.5, 14.6, 14.24	Varies
Reactor Coolant	PLDBD-RC-128, Att 15	Rev. 1
Reactor Coolant Pump Operation	OI-RC-9	23
See Attached page		

9.1.2 Identify Applicable NRC Documents/Industry Standards (Write NONE if none identified)

Title	ID Number	Revision
Reactor Coolant Pump Flywheel Integrity	Reg. Guide 1.14	1
Control of Heavy Loads	NUREG 0612	1980
Seismic Qualification of Class 1E Equip for NPGS	IEEE 344	1975
Oil Collection System for Reactor Coolant Pumps	10CFR50 App. R , III.O	

9.1.3 Identify Related Drawings (Write NONE if none identified)

Title	ID Number	Revision
GE Motor-Vertical Induction Motor Outline	531E500	11
ABB Motor-Outline	HTAM125293	B
See Modification Section 5.3 for additional dwg list		

9.2 List safety functions the affected structures or components perform:(Write NONE if none identified)

The motor flywheel reduces the rate of flow decay upon loss of power (Ref. USAR 4.3.5, 14.6.1, 14.6.2). The motor must be designed to completely contain the largest conceivable missile in the event of a flywheel failure (...AR 4.3.5).

List applicable accidents for which these safety functions are required:(Write NONE if none identified)

Loss of Coolant Flow Event (Ref. USAR 14.6.1).

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Section 9.1.1 Continued.

Document Title	ID Number	Revision
Heavy Loads	PLDBD-CS-52, Sect 4	1
Heavy Loads Review	PED-GEI-17	2
Reactor Coolant Pump Motor Removal	EM-RR-RC-1003	0
Internal Missile & HELB	PLDBD-ME-11, Sect 5.1	4
Exemption From the Requirements of App. R	LIC88-457, 12-20-88	-
Seismic Qualification of Motor Structure	HTAM622596	3
FE-Analysis of the Lift Load Path	HTAM622628	0
Design Slings for Four Lifting Operations	FC06576	A
CAS-45/WDS-186 Support Qualification	FC06586	A
RC-3B Pump Snubbers' Plate Attachment	FC06580	A
See modification Section 5.1 for additional calculations.		
GE Vendor Manual (Exist. Motor)	TM G080.2220	1
ABB Squirrel Cage Motor Manual	QOVG900 FA 6	-
RCP Motor Specification	Contract 1977	0 (addendums)
~~EGS Report No. SAIC-TR-757.200-02~~ Dedication of ABB RCP Motor	EGS Report No. SAIC-TR-75\800-02	Rev. 0 & A

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ATTACH OR REFERENCE OTHER DOCUMENTS AS NECESSARY.

9.3 System Interactions Analyses

Criteria	Applicable	Criteria	Applicable
Fire Protection	X	Structural Impact	X
Electrical Equipment Qualification		Separation Criteria	
High Energy Line Break Review		Single Failure Criteria	
Seismic Interaction and Qualification	X	Possibility of Operator Error	
Electrical Systems Analysis	X	Heavy Loads	X
Human Factors Review		Impact on HVAC	
Security Review		System/Component Performance	X
Environment Radiological Release		Natural Phenomena	
Materials Compatibility	X	Missile Protection	X
Containment Integrity		Control Room Habitability	
Other:			

Discussion of Applicable Systems Interactions Analyses

(Include Attachment Sheet as needed, write NONE if none identified)

Fire Protection: The replacement motor oil collection system is designed to meet 10CFR50, Appendix R, Section III.O, except for the lower oil cooler piping and instruments external to the oil cooler. As with current motors, an exemption for the lower oil cooler external piping and instruments will be requested based on similarity of the two motors. The replacement motor requires less total oil, both the upper and lower oil reservoirs combined, than the existing motor. The station Fire Hazards Analysis or fire detection or suppression systems are not affected.

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SEE NOD-QP-3 FOR INSTRUCTIONS

ATTACHMENT SHEET

Section 9.3 continued.

Seismic Interaction and Qualification: Nominal weight of the existing motor and replacement is approximately 64,000 lbs. Overall size and shape is nearly the same for motors. The replacement motor has center of gravity at 68.9" from the bottom of the motor mount flange while the existing motor center of gravity is 72". Also, the replacement motor is designed to maintain structural integrity under the normal operating conditions concurrent with Design Basis Earthquake (ref. Calcs HTAM622596, Rev. 3). The replacement motor does not adversely impact the reactor coolant pump or the reactor coolant system piping and support system.

Hanger WDH-317 provides dead load support for 4" diameter waste disposal piping in containment above the equipment hatch. Currently, WDH-317 prevents full opening of the equipment hatch. Adjacent to this support is a seismic restraint WDS-186 which is more rigidly built and capable of taking additional pipe dead load currently provided by WDH-317 (ref. Calc. FC06586, Rev. A). Therefore, WDH-317 will be removed or abandoned in-place.

The existing four horizontal snubber attachments do not fit on the new motor. New snubber attachments will be fabricated from A-36 steel plates with attachment accessories. Calculation FC06580 concluded that the snubber ratings are not affected by the changes.

Electrical Systems Analysis: The new motor will be powered by the same circuit breaker (Bus 1A2, Breaker 5) and existing cables will be used to feed the new motor. The 480 V feeds and control circuitry for the oil lift pump motor and the motor space heater will also be unaffected by this modification. The new motor has the same horsepower, voltage, and current rating as the existing motor.

The instruments for the new motor will be like the existing instrumentation. The vibration monitoring system will be the same equipment that is currently on the existing motor. Oil reservoir level indication remains an analog signal to the ERF Computer, and alarms on low lube oil level.

Materials Compatibility: The replacement motor has basically the same materials as the existing motor. The motor housing is carbon steel, copper winding, and stainless steel on various motor sub-components such as the oil collection system.

Structural Impact: The new and replacement motor weigh approximately 64,000 lbs. There is no adverse impact on the motor supporting structures.

Heavy Loads: The new and existing motor weigh approximately 64,000 lbs. The motor lifting lugs are designed such that two adjacent lugs 60 degrees apart are capable of lifting the motor. A safety factor of 5 was built into the motor lug design (Calc. HTAM622628, Rev. 0). Calculation FC06576, Rev. A, evaluated the three motor lifting operations and has designed the slings with a minimum safety factor of 5. The motor lifting lugs and lifting devices are adequately designed. See Installation FC-154 for capacity of the lifting devices.

Continued on attached page.

ATTACHMENT SHEET

Section 9.3 continued.

System/Component Performance: The new motor performance is basically the same as the existing motor except the new motor full load speed will be approximately 1193 rpm compared to 1191 rpm for the existing motor. The nominal GE motor speed is 1185 rpm and the actual measured speed is approximately 1191 rpm. This will result in approximately 0.17% flow increase in the pump. Increase in pump flow rate is considered inconsequential on fuel rod fretting wear and failure and has no measurable impact on USAR Chapter 14 Safety Analysis.

The new motor coast down time is same as the existing motor since both motors have 70,000 lbs-ft^2 rotational energy. The 70,000 lbs-ft^2 rotational energy is from the motor and rotational energy of the pump is not included. Therefore, the minimum DNBR of 1.18 will be maintained as described in USAR Chapter 14.6.1. Also, the probability of a seized rotor event is not changed.

The CQE components of the motor are the flywheel, CCW piping, and oil coolers. See modification section 3.2 for quality class designations.

Missile Protection: Current GE motors have a shroud around the flywheel to contain flywheel fragments in case of a flywheel failure. As previously stated in Section 8.7, the new motor flywheel is designed such that a flywheel failure is not a credible event, therefore, a shroud is not included.

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Unreviewed Safety Question Determination
ATTACH OR REFERENCE OTHER DOCUMENTS AS NECESSARY.

9.4 Could the proposed activity increase the probability of occurrence of an accident previously evaluated in the USAR? Explain: The new motor does not affect overall Reactor Coolant System (RCS) or pump performance. The new motor monitoring instrumentation is equivalent to the existing motor. The motor design, material, fabrication, and construction standards meet the motor Contract 1977 and it will have equivalent or better reliability as compared to the existing motor. No increase in the probability of an RCP related USAR accident is credited.	YES [ ] NO [X]
9.5 Could the proposed activity increase the consequences of an accident previously evaluated in the USAR? Explain: Loss of power and seized rotor events evaluated in USAR 14.6 are not impacted by this modification. On loss of power, the motor flywheel, as with the original motor, reduces the rate of flow decay as credited in the USAR. Consequences of a seized rotor or mechanical failure is not increased since the new motor has mechanical and electrical controls that are equivalent to the original motor. Operational characteristics of the motor are not significantly changed.	YES [ ] NO [X]
9.6 Could the proposed activity increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the USAR? Explain: The new motor does not adversely affect the Reactor Coolant Pump (RCP) or the RCS piping and supports. Both the new and existing motor weigh approximately 64,000 lbs. The new motor is designed to maintain structural integrity under the normal operational conditions concurrent with a safe shutdown earthquake. The motor flywheel is a forged single piece design which is shrink fit to the motor journal and a flywheel failure is not considered to be a credible event.	YES [ ] NO [X]
9.7 Could the proposed activity increase the consequences of a malfunction of equipment important to safety previously evaluated in the USAR? Explain: The new motor design, material, and construction are equivalent to the existing motor. A failure of the new motor does not increase the consequences of malfunctions of equipments important to safety since it is an equivalent substitute mechanically and electrically. A failure of the new motor does not create a new failure mechanism for equipment important to safety.	YES [ ] NO [X]

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Unreviewed Safety Question Determination
ATTACH OR REFERENCE OTHER DOCUMENTS AS NECESSARY.

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R13

9.8 Could the proposed activity create the possibility of an accident of a different type than any previously evaluated in the USAR? Explain: This modification does not change the RCS configuration other than replacing a RCP motor with an equivalent motor. No new accident scenarios are applicable since the new motor does not change the operational characteristics of the RCS or RCP. The possibility of a flywheel failure and generating missiles in containment is not a credible event for the new motor. Therefore, a shroud around the flywheel is not included in the motor design.	YES [ ] NO [X]
9.9 Could the proposed activity create the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the USAR? Explain: The new motor is an equivalent replacement for the existing motor. Mechanical and electrical controls are same for the new motor. The new motor does not create a new failure mechanism for safety related equipment.	YES [ ] NO [X]
9.10 Does the proposed activity reduce the margin of safety as defined in the basis for any Technical Specification? Explain: Reactor Coolant System performance, operations, or Limiting Conditions for Operation as described in the Technical Specifications are not affected. Therefore, Technical Specification margins of safety are not affected by this modification.	YES [ ] NO [X]

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NUCLEAR SAFETY EVALUATION
SEE NOD-QP-3 FOR INSTRUCTIONS
SECTION B - Design
Unreviewed Safety Question Determination

ATTACH OR REFERENCE OTHER DOCUMENTS AS NECESSARY.

IF ANY QUESTION (9.4-9.10) IS ANSWERED YES, THE ACTIVITY INVOLVES AN UNREVIEWED SAFETY QUESTION AND CAN NOT BE PERFORMED WITHOUT PRIOR NRC APPROVAL. DO NOT COMPLETE THIS PAGE. SEE NOD-QP-3 FOR INSTRUCTIONS.

9.11 Summarize USAR changes which are needed or attach marked-up copy of affected pages:

NOTE: ASSUMPTIONS, OPERATING OR ADMINISTRATIVE RESTRICTIONS REQUIRED TO JUSTIFY THAT THE ACTIVITY IS NOT AN UNREVIEWED SAFETY QUESTION MUST BE INCORPORATED INTO THE USAR.

Specific RCP motor flywheel design, fabrication, and testing information for the ~~existing~~ new motor will be ~~removed~~ added ~~from~~ to USAR Section 4.3.5. ~~along with Fig. 4.3-6, 12, 13, and 14. Flywheel information for the new and existing motor will be on dwgs. B-4205 and B-4206. The USAR figures will be available as OPPD drawings but not included in the USAR.~~ See attached markups. 2

9.12 Report of 10 CFR 50.59 changes, tests and experiments.

Provide a brief description of the activity: This modification replaces GE Reactor Coolant Pump, RC-3B, motor with a ABB motor. The new motor is basically the same as the existing motor except that it does not have a shroud around the flywheel. This configuration is acceptable based on low probability of a flywheel failure due to the design, material, and fabrication controls. The new motor complies with RG 1.14, Rev. 1, Reactor Coolant Pump Flywheel Integrity, and is an acceptable replacement.

Summarize the safety evaluation:

RCP motor replacement does not create unreviewed safety concerns and it is within the USAR Chapter 14 Safety Analysis.

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GENERAL FORM NUCLEAR SAFETY EVALUATION - Design FC-154 R16

Nuclear Safety Evaluation Conclusion Page 14 of 29

IF ANY QUESTION (9.4-9.10) IS ANSWERED YES, THE ACTIVITY INVOLVES AN UNREVIEWED SAFETY QUESTION AND CANNOT BE PERFORMED WITHOUT PRIOR NRC APPROVAL.

[X] This activity is being done pursuant to 10 CFR 50.59. This activity MUST be approved by the PRC.

- This safety evaluation must be reviewed by SARC; ref Tech. Spec. 5.5.2.7.
- This activity must be reported in the 10 CFR 50.59 report; ref 10 CFR 50.59, Item b, Paragraph 2.

[ ] This activity involves an Unreviewed Safety Question. The activity must be canceled, or revised and re-evaluated, or NRC authorization is required prior to implementation; ref 10 CFR 50.59, Item c.

We hereby certify that this Nuclear Safety Evaluation is complete and accurate to the best of our knowledge.

Preparer (Print Name): Erick Jun	Extension: 6772
Signature: Erick Jun	Date: 9-19-96
Reviewer (Print Name): John C. Adams	Extension: 6844
Signature: John C Adams	Date: 9-20-96

Erick Jun — Preparer — 10-17-96 Date

Reviewer — FOR FDCR 96-0186 CHANGES ONLY — 10-18-96 Date

FDCR 96-0186 (1)

Erick Jun — Preparer — 11-12-96 Date

Reviewer — 11/15/96 Date

Reader: Alan W. Richard (2)

FILE - Rev 1

Attachment B - Operability Evaluation Form

CR No. 1996001624

Initiating Event: Oil Leakage of RC-3D Motor (Maint., Surveillance, etc.) Date: 1/14/97

I. Affected Item (SSC): **Equipment Tag No.** RC-3D-M

II. Describe the ***operability concern*** associated with the affected item, including a discussion of the requirement or commitment established for the item and why the requirement or commitment may not be met:

See Attached

III. Describe the ***intended safety function(s)*** of the affected item (See Section 6.4.2):

See Attached

IV. List references used (See Section 6.4.3):

See Attached

V. Based on a review of the intended safety function(s) of the affected item and the operability concern (See Section 6.3.2):

✓ The item is OPERABLE, or

___ The item is INOPERABLE **(IMMEDIATELY NOTIFY THE SHIFT SUPERVISOR)**

********OPTIONAL********

___ Preliminary determination is as above. Further determination/evaluation must be made by the Production Engineering Division. EAR #_____ has been issued.

10

Attachment B

CR No. 1996001624

VI. Justification of Decision (See Section 6.4.4):

See Attached

VII. List any recommended corrective actions to correct the initial operability concern.
SEE CR # 1996001624

* Prepared by: J Allen - Jim Allen Date: 1/14/97 Time: 1630
(10 CFR 50.59 Preparer Qualified)

Reviewed by: K Erdman - Kal Erdman Date: 1/15/97 Time: 1500
(10 CFR 50.59 Reviewer Qualified)

**Independent Review by: Alan W. Richard Date: 1/15/97 Time: 1525
(10 CFR 50.59 Reviewer Qualified)

[ ] Interdisciplinary review required. Conclusions of review attached.

† ISI Coordinator: N/A Date: 1/15/97 Time: 1530

Concurrence: Carl Jensen Date: 1.15.97 Time: 2230
(Licensed Senior Operator)

Concurrence: [signature] Date: 1-15-97 Time: 2248
(Shift Supervisor)

Concurrence: for JKC Date: 1/16/97 Time: 0925
(Plant Manager/Manager-Operations)

* NOTE: All Operability Evaluations REQUIRE PRC Review.

** The Independent Reviewer shall determine the need for an interdisciplinary review and lead the review if one is required. The conclusions of the interdisciplinary review shall be documented, signed by the members of the interdisciplinary review team and attach to this NOD-QP-31 form.

† ISI Coordinator's signature ONLY required for ISI-related SSC.

II. Description of operability concern

The Reactor Coolant Pump (RCP) Motor RC-3D-M operability concern is with the excessive amount of oil usage and leakage outside of the oil collection system during startup following the 96 refueling outage. This loss of oil is caused by an internal leak of non-pressurized oil from the upper oil reservoir. With the leak path outside of the oil collection system, the lost oil increases the RCP bay fire loading. This oil leak has also resulted in some oil on internal motor components.

As a brief history, following the replacement of the RCP motor lube oil coolers in May of 95, RC-3D has had a history of excessive oil leakage when the upper oil reservoir is filled to normal operational levels. This problem had been noted before on RC-3D. However, the prior problem had been limited to when the upper reservoir was over-filled. Once the oil level returned to normal levels the leakage stopped and oil usage rates returned to normal.

In comparison, since May of 95, RC-3D has lost oil until the reservoir level reaches a level at the low end of its operating range. Last cycle the motor was operated at a reduced reservoir level to minimize oil usage. This in turn resulted in an increase in the number of times oil was added to RC-3D. With the start of cycle 17, RC-3D will again be operated at a reduced oil level. Initial indications are that the number of times oil will be added to RC-3D should be greatly reduced compared to cycle 16. RC-3D is currently operating with almost no oil usage.

Since the end of the RFO in November, the motor has lost an estimated 2 to 3 gallons of oil. Most of this oil leakage was not collected in the oil collection system. Oil was observed on the walkways and floor directly below the motor. Oil had also wetted internal portions of the motor. The floor and walkways around RC-3D were re-cleaned prior to taking the plant critical. No further inspections have been performed with the Plant in power operations, however, from oil reservoir level indication some leakage has continued after this final cleanup.

As previously mentioned, the oil leak is an internal motor leak that is not collected by the oil collection system. During plant startup in November 96, oil was observed to be dripping out of several ports and drains from the internal portions of the motor above the rotor shaft air seal. This leakage path bypasses the oil collection system. The leakage has been quantified as 2 to 3 gallons over a several week period. Leakage can be seen coming out of the several drains as a drip every several minutes when the motor is leaking at its maximum rate(during initial motor startup).

To summarize the following are the specific motor operability concerns:

- The fire hazard associated with oil outside of the oil collection system. Some additional leakage outside of collection system is anticipated when ever the upper reservoir is refilled during the cycle.
- The additional fire loading in the bay with oil on adjacent equipment and floor/walkways.
- Operation of RC-3D with reduced oil levels in the upper reservoir.
- Operation of RC-3D with oil on the internal motor components.

III. **Description of intended safety function(s) of affected items**

1) The RCP motor lube oil collection system's safety function per the requirements of Appendix R is to "be so designed, engineered, and installed that failure will not lead to fire during normal or design basis accident conditions and that there is reasonable assurance that the system will withstand the Safe Shutdown Earthquake."

Per a review of the RCP oil collection system DBD reference, the RCP oil collection system is designed to contain a pressurized oil leak from a crack in any part of the lubrication system external to the RCP.

2) Affected portions of the motor have a significant impact on plant reliability, however, this equipment does not perform a safety function. The only safety related motor components on the motor are structural components, ~~and~~ the fly wheel. These safety related components/functions are unaffected by the oil leakage. and CCW components. JH 1/15/97

3) A number of RCS related components in close approximation to the motor are required to perform a safety function and could potentially be affected from a fire.

IV. **References**

1) EA 97-002, "RCP Lube Oil Fire Hazard Evaluation", draft
2) 10CFR50, Appendix R, Section III.0
3) OPPD Fire Protection Program Submittal, LIC-76-0180, dated 12/31/76
4) EAR 95-086 evaluation on the increases in fire loading
5) Program SER, LIC-78-0104, dated 8/23/78
6) RCP Lube Oil Design Package, NRC Submittal, LIC-79-0059, dated 6/6/79
7) SER Supporting Amendment #53, dated 11/17/80
8) NRC Triennial Inspection Report, LIC-88-880, dated 9/23/88
9) OPPD Exemption Request, LIC-88-1066, dated 11/28/88
10) NRC Exemption to Appendix R, III.0, LIC-88-457, dated 12/20/88

VI. **Justification of Decision**

A. <u>Justification of Oil Leakage Outside of Collection System:</u>

The RCP motor lube oil collection system configuration is in conformance with the SER approved design. The Fire Hazards Analysis Design Basis Fire in containment assumes a 150 gallon lube oil burn in an RCP bay. The nominal capacity of single RCP motor lube oil inventory is approximately 115 gallons. With the current lost of oil plus any further anticipated loss of oil during the cycle, the oil inventory in the bay (including the oil in the motors) is still within the 150 gallon assumption. Compensatory actions will be taken to ensure that during the cycle oil added to the motor does not challenge the 150 gallon fire loading.

To evaluate the fire risk concern of oil leakage outside of the oil collection system the leakage needs to be characterized. This includes where and what surfaces the oil will contact and why this oil leakage does not affect equipment operability.

1) Oil Leakage to the Floor and Walkways

Most of the oil that leaks outside of the collection system comes from the various motor drains and inspection ports above the rotor shaft air seal. This oil drips to the floor and walkways under the motor.

The oil on the floor and walkways is considered a minimal fire hazard with no ignition source near the puddles of oil. In addition the high air flow rates from the motor and the containment ventilation prevent any possible buildup of a potentially flammable vapor. This small quantity of oil is within the previously analyzed fire loading for the bay.

2) Oil Leakage on Hot Insulated RCS Components

Some of the oil that has leaked outside of the collection system may come into contact with hot RCS components. The oil used in the RCP motors when in contact with hot RCS components has the potential to be combustible under certain conditions. Arkansas Nuclear One (ANO) had a recent event where a large quantity of oil from a leak in a pressurized lube oil system soaked RCS insulation during cold shutdown conditions. Upon plant heatup, the wicking action of the oil in the insulation next to the hot RCS ignited the oil. The ANO collection system was not enclosed which allowed direct impingement of lube oil on to the RCS from a pressurized source. FCS collection system is enclosed, thus this condition does not exist at FCS.

The RCP and piping under and around the RC-3D motor has a metal jacket over the insulation which prevents oil soaked insulation. With the insulation covered and the FCS's collection system, minor leakage that reaches the piping/pump below continues running to the floor(994' elevation). The impact therefore of oil dripping on surrounding piping/pump is of minimal concern.

3) Oil Leakage on Hot Un-Insulated and Exposed Blanket Insulated RCS Components

A small quantity of oil coming in contact with un-insulated hot RCS components or RCS components covered with exposed blanket insulation has been considered. This oil is transported either directly from oil blown through the motor or carried by the containment ventilation system. To address this concern an evaluation performed to address the previously described ANO event has been summarized.

- An exposed section of blanket insulation on RC-3A (unlike the jacket insulation on RC-3D) was sampled and evaluated during the 96 RFO. This was performed to determine if over the years (approximately 10 years) oil had soaked into the insulation as a result of a number of small leaks on the above motor. The insulation was found to be completely dry(non-flammable). The only indication of previous oil leakage was a brown residue left on the surface of blankets. This brown residue was the remaining oil components after all the flammable components have been driven off the insulation from the high RCS temperatures.

With no mechanism to allow the buildup of oil on hot exposed RCS surfaces or vaporized combustibles to accumulate, the fire hazard concern with the small quantities of oil impinging on these surfaces is considered minimal. Therefore the amount of oil impinging on RCS surfaces from the small RC-3D leak has no significance.

B. Justification of Operation with Oil on Internal Motor Components:

1) Motor reliability

Internal oil leakage has no effect on motor operability or reliability. This conclusion is based on FCS operating experience and similar motors in the industry. The motor manufacturer (GE) concurs that oil on various internal motor components does not directly affect motor operation. As further justification, RC-3B motor is currently being refurbished with no indication that after 23 years of service internal lube oil leakage has caused any degradation. Internal oil leakage has been observed at times in all of the motors(usually associated with over filling the upper reservoir).

The RC-3D motor will continue to be operated with reduced oil level in the upper reservoir to minimize leakage. Appropriate compensatory actions including additional operational guidance (OI-RC-9) have been taken to ensure the motor can be operated reliably with the reduced oil level to control the amount of oil usage during the cycle.

2) Fire Hazard of Oil on Internal Motor Surfaces

A concern has also been identified regarding the fire hazard of oil on internal motor surfaces. This small amount of oil on internal motor surfaces provides no additional significant fire loading versus the 115 gallons already in the motor. In addition, all of the oil in the motor is subject to the same ignition sources. A major motor failure (ie. major mechanical failure or major electrical fault) could potentially ignite a number of motor components including the oil in the motor. The addition of the small quantity of oil on internal motor surfaces does not provide any significant additional fire hazard then what has already been previously evaluated for the complete motor oil collection assembly.

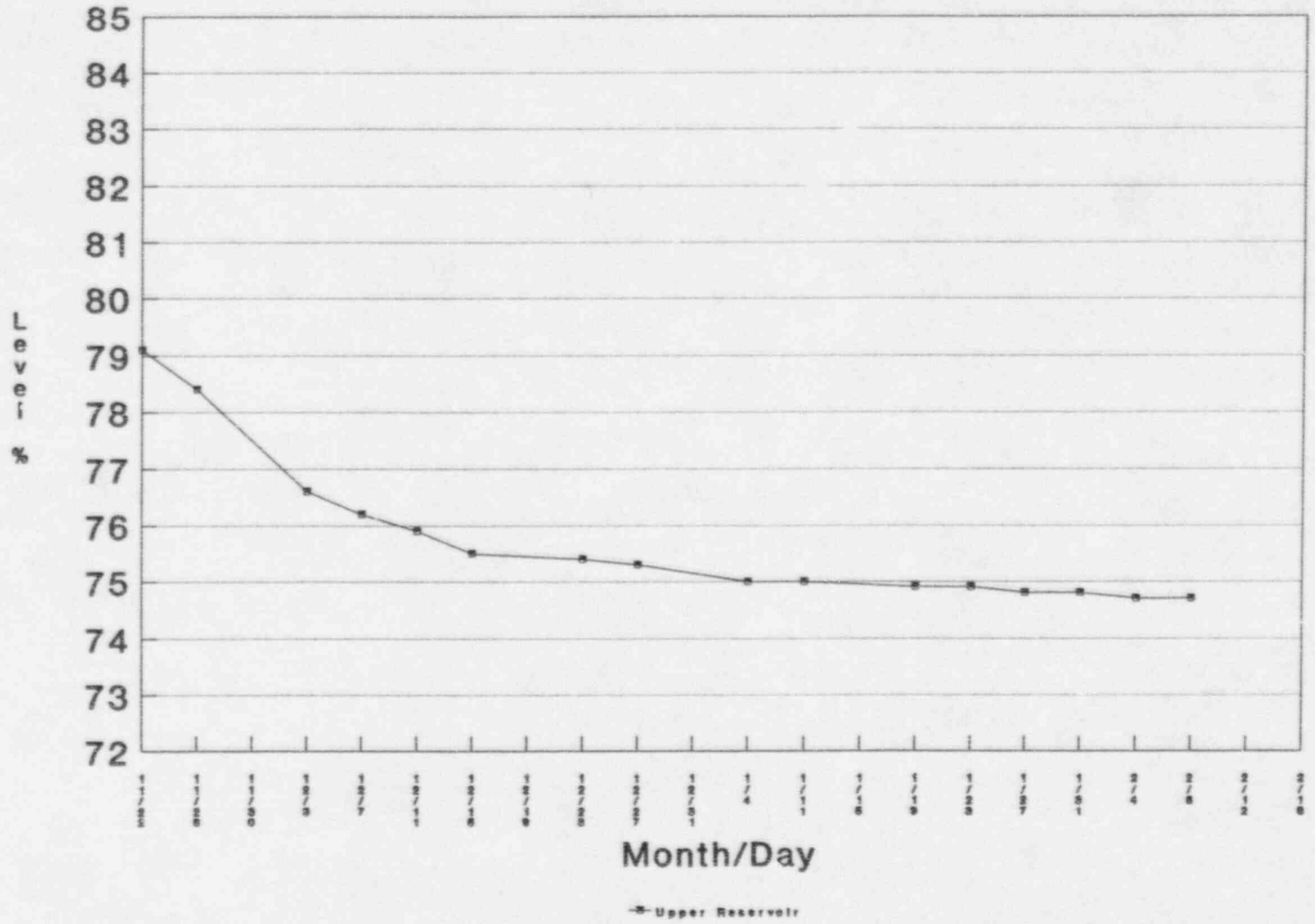
C. Conclusions:

Although oil leakage outside of the motor oil collection system is undesirable, the minimal increase in fire hazard risk is acceptable and within design basis and can be managed with the following compensatory actions:

- RC-3D motor oil usage is monitored and controlled to ensure compliance with 150 gallon total fire loading assumption. The clean up and removal of the oil, as plant operation conditions permit, will be factored into the 150 gallon limit.

- Operation of RC-3D at reduced oil levels to minimize oil usage. The amount of oil added during the cycle will be minimized to limit leakage.

RC-3D Motor Reservoir Levels



11/96 to 2/98

Fort Calhoun Station
Unit No. 1

OI-RC-9

OPERATING INSTRUCTION

Title: REACTOR COOLANT PUMP OPERATION

FC-68 Number: 46921

Reason for Change: Incorporated OPS Memo 96-06 into appropriate sections of OI-RC-9. Revised Data Table 2, incorporating normal parameters specific to RC-3B.

Contact Person: S. Clayton

PRECAUTIONS (Continued)

17. WHEN the RCS pressure is <425 psia, THEN the Pressurizer pressure indication is less accurate. Steam Tables shall be used to determine actual pressurizer pressure by comparing Pressurizer liquid temperature with the saturation pressure to determine adequate Reactor Coolant Pump Net Positive Suction Head (NPSH).

18. A Reactor Coolant Pump shall NOT be operated without controlled bleedoff flow established. Normally, Reactor Coolant Pump controlled bleedoff is established whenever, the RCS is pressurized (does not apply to an uncoupled RCP).

19. IF Component Cooling Water is lost to the pump motors, THEN the Reactor Coolant Pump Motor(s) shall NOT be operated for more than five minutes, follow guidance of AOP-11.

20. RCS pressure of 2500 psia shall NOT be exceeded during RCP operation.

21. During RCP operation, if a valid temperature indication for the motor radial or thrust bearing shoes exceeds 203°F for RC-3A, 3C and 3D or 230°F for RC-3B, OR if an abnormal temperature rise of 10°F per minute is noticed during steady state pump operation, the Reactor shall be SHUTDOWN, and the RCP shall be immediately stopped and the affected bearing(s) inspected.

22. While the RCP(s) are running, if the lower seal temperature exceeds 200°F, the Reactor shall be SHUTDOWN and the RCP shall be immediately stopped. Restart shall NOT be permitted until all O-rings, seal faces and U-cups have been inspected or replaced. Before starting, the RCP Seal Cavity temperature usually exceeds 200°F, but should cooldown shortly after RCP has been started.

23. Due to the present inadequate lube oil flow monitoring capability of the ARRD Lube Oil Flow Pressure Switches for RC-3A, RC-3C and RC-3D when these pumps are running (i.e., the oil lift pump is "OFF"), compensatory measures are warranted to monitor for adequate flow to the ARRD. Therefore, vibration trends of the RCP motor upper guide bearing should be taken each shift for all four RCPs and the results recorded in the Turbine Building Log (FC-78). If any of the three vibration trend lines (max, average, min) on the RCP motor upper guide bearing has increased or decreased by more than 2 mils over a one week (or less) time frame, the responsible System Engineer shall immediately be notified and the trend evaluated.

24. IF the Vibration Alarm on an operating RCP is IN ALARM, THEN action shall be taken in accordance with the ARP and OI-RC-13. OI-RC-13 provides guidance for operation of the Vibration Monitoring System (AI-270) including response to alarms for both normal RCP operation and pump starts.

25. Any deviations or discrepancies shall be immediately reported to the Shift Supervisor.

Table 4
REACTOR COOLANT PUMP **RC-3D** NORMAL OPERATING PARAMETERS

INDICATION	DESCRIPTION	EXPECTED VALUE AT 532°F/2100 PSIA	ALARM VALUE
FI-453	Seal Cool Out-Flow (CCW) (AI-45)	40 gpm (25-55 gpm)	N/A
FI-457	Lube Oil Cool Out-Flow (CCW) (AI-45)	30 gpm (20-40 gpm)	N/A
TI-461	Seal Cool Out-Temp (CCW) (CB-1)	80°F (60-100°F)	120°F
TI-465	Lube Oil Cool Out-Temp (CCW) (CB-1)	80°F (60-100°F)	120°F
TI-2800	Discharge Header Temp (CCW) (CB-1)	70°F (55-90°F)	120°F
F3191	Lube Oil Low Flow	Normal	Low ***
F3190	Oil Flow to ARRD Alarm	Normal ******	Lo Flow ***
P3189	Oil Filter Delta-P	Normal	High ***

*** Utilize the Upper Guide Bearing Temperatures, Upper Thrust Bearing Temperatures and RCP Vibration (AI-270) indications to ensure the pump/motor combination is performing as expected, then contact System Engineering for further guidance.

**** The ERF level alarm setpoint may be lowered to 73%. Maintenance personnel shall be tasked to fill the reservoir prior to reaching a upper oil reservoir level of 73%. The upper guide bearing temperature should also be monitored for increasing temperatures. An increase in bearing temperature of 5 to 10 degrees over several days with no concurrent change in CCW cooler flow or temperature is an indication that adding oil is required and the System Engineer be notified.

***** An increasing trend is of much greater significance than the actual bearing temperatures, however a bearing temperature above 170°F is clearly above expected values (even during the summer months). As an additional aid to identify an increase in upper guide bearing temperature, the difference between the upper guide bearing and lower thrust bearing temperatures can be calculated. The nominal temperature difference is 20°F DELTA T, regardless of changes in CCW temperature or flow. If the temperature difference increases above a delta T of 30°F, the bearing is outside of the expected temperatures and should be evaluated by System Engineering.

****** Due to the present inaequate lube oil flow monitoring capability of the ARRD Lube Oil Flow Pressure Switches for RC-3A, RC-3C and RC-3D when these pumps are running (i.e., the oil lift pump is "OFF"), the expected value is Low Flow when the RCP Oil Lift Pump is NOT running.

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