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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO THE PROPOSED SAFE SHUTDOWN SYSTEM

AND EXEMPTION REQUESTS CONCERNING 10 CFR PART 50, APPENDIX R

FORT ST. VRAIN NUCLEAR GENERATING STATION

PUBLIC SERVICE COMPANY OF COLORADO

DOCKET NO. 50-267

1.0 INTRODUCTION

This Safety Evaluation addresses the compliance of the Fort St. Vrain Nuclear Generating Station (FSV) with 10 CFR Part 50, Appendix R, Sections III.G and III.J, concerning fire protection programs for nuclear power facilities. The NRC regulatory criteria that form the complete fire protection licensing basis for FSV also include:

- Appendix A to Branch Technical Position APCSB 9.5-1, Rev. 1, and

- PSC letter of August 17, 1984 from Lee to Johnson (P-84281) (Reference 14). This is also contained as Appendix A of Reference 1a.

By letter dated August 3, 1987 (Reference 15), the NRC reaffirmed that the above positions represented the applicable regulatory basis for fire protection at Fort St. Vrain. This position has remained unchanged from earlier correspondence, including Reference 13. This evaluation discusses both the proposed post-fire shutdown systems and the exemptions requested.

1.1 Post-Fire Shutdown Systems

A review of the post-fire safe shutdown systems, proposed by Public Service Company of Colorado (PSC) for FSV fire protection considerations, entitled "Fire Protection Shutdown/Cooldown Model," was undertaken by Region IV personnel in accordance with TIA 83-105 in October 1985. The initial review of the PSC proposal (Reference 1) resulted in a number of questions which were transmitted to PSC by NRC letter dated November 1, 1985 (Reference 3). PSC responded to these questions in their December 20, 1985 letter (Reference 4) which deferred the submittal of an analysis to justify the effectiveness of the proposed post-fire shutdown models until the fourth quarter of 1986. A proposed FSV fire protection program plan was submitted December 15, 1987 (Reference 20) per Generic Letter 86-10.

Review of the December 20, 1985 response resulted in a number of followup and clarification questions which were discussed during a telephone conference on February 26, 1986, and documented in PSC letters dated March 14 and April 4, 1986 (References 5 and 6, respectively).

1.2 Exemption Requests

By letter dated April 1, 1985 (Reference 1d), the licensee submitted Appendix R Evaluation Report No. 4, which contained exemption requests and proposed fire protection and systems-related modifications. Eleven exemptions from the technical requirements of Section III.G and one exemption from Section III.J of Appendix R to 10 CFR Part 50 were requested.

A schedular exemption from 10 CFR 50.48 was also requested. However, in a letter dated July 22, 1986 the staff stated that this exemption was not needed.

By letter dated May 31, 1985 (Reference 2), the licensee submitted Report No. 5, "Fire Hazards Analysis and Evaluation of Fort St. Vrain Building No. 10 to BTP 9.5-1, Appendix A Guidelines."

Section III.G.2 of Appendix R requires that one train of cables and equipment necessary to achieve and maintain post-fire shutdown be maintained free of fire damage by one of the following means:

a. Separation of cables and equipment and associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier;

b. Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; and

c. Enclosure of cables and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area.

If these conditions are not met, Section III.G.3 requires an alternative shutdown capability independent of the fire area of concern. It also requires that a fixed suppression system be installed in the fire area of concern if it contains a large concentration of cables or other combustibles. These alternative requirements are not deemed to be equivalent; however, they provide equivalent protection for those configurations in which they are accepted.

Because it is not possible to predict the specific conditions under which fires may occur and propagate, the design basis protective features are specified in the rule rather than the design basis fire. Plant-specific features may require protection different from the measures specified in Section III.G. In such a case, the licensee must demonstrate, by means of a detailed fire hazards analysis, that existing protection or existing protection in conjunction with proposed modifications will provide a level of safety equivalent to the technical requirements of Section III.G of Appendix R.

In summary, Section III.G is related to fire protection features for ensuring that systems and associated circuits used to achieve and maintain post-fire shutdown are free of fire damage. Fire protection configurations must either meet the specific requirements of Section III.G or an alternative fire protection configuration must be justified by a fire hazard analysis.

Our general criteria for accepting an alternative fire protection configuration are the following:

- ° The alternative ensures that one train of equipment necessary to achieve hot shutdown from either the control room or emergency control stations is free of fire damage.
- ° The alternative ensures that fire damage to at least one train of equipment necessary to achieve cold shutdown is limited such that it can be repaired within a reasonable time (minor repairs with components stored onsite).
- ° Modifications required to meet Section III.G would not enhance fire protection safety above that provided by either existing or proposed alternatives.
- ° Modifications required to meet Section III.G would be detrimental to overall facility safety.

2.0 EVALUATION

2.1 Post-Fire Shutdown Systems

The evaluation of the post-fire shutdown system was based on the Appendix R fire protection regulatory guidance contained in PSC's August 17, 1984 letter. This letter is included as Appendix A to Report No. 1 (see References 1a and 14) and reflects the guidance provided by the NRC staff for fires in congested cable areas and noncongested cable areas.

It was noted (see Figures 4.4 through 4.18 of Reference 1c) that some electrical cables for Train A and Train B components are located in close proximity within the same fire area(s). The licensee is rerouting some of these cables to improve separation, and it is expected that the electrical separation specified in the exemption requests and proposed modifications will be verified during NRC inspections, after modifications are complete.

2.1.1 Congested Cable Areas

The criteria delineated in the regulatory guidance for fires in congested cable areas were based on the use of the Alternate Cooling Method (ACM). The congested cable areas are defined as the Control Room, 480 Volt Switchgear Room, the Auxiliary Electric Room, and the congested cable area along the "G" and "J" walls (see References 13 and 14).

The ACM is an independent, diesel driven, 2500 kW electrical generator with an associated distribution system that is used to provide power to selected plant components through manual transfer switches. Under ACM liner cooldown, the initial action is depressurization which must be initiated within approximately 2 hours; other actions are not required for a much longer time period (e.g., li r cooling must be initiated within 28 hours), but can be initiated much sooner. The ACM provides a source of Prestressed Concrete Reactor Vessel (PCRV) Liner Cooling Water (LCW). The procedure used to place the ACM in operation is AOP 48-01.

The NRC approval of the ACM is contained in the Safety Evaluations enclosed in License Amendments 14, 18 and 21 (References 7, 8 and 9).

Since the licensee states (see References 4 and 5, Item 6.b) that "the design, loads and intent of the ACM has not been modified significantly since its use was approved," no additional review or approval was required.

2.1.2 Noncongested Cable Areas

The criteria delineated in the regulatory guidance for fires in noncongested cable areas were based on the requirements contained in Section III.L of Appendix R to 10 CFR Part 50. The application of these criteria that apply to Fort St. Vrain is specifically defined in References 13 and 14. The limiting consequences require that, "For any single fire in a non-congested cable area, means shall be available to shut down and cool down the reactor in a manner such that no fuel damage occurs (i.e., maximum fuel particle temperature does not exceed 2900 degrees F). There shall be no simultaneous rupture of both a primary coolant boundary and the associated secondary containment boundary such that no unmonitored radiological releases of primary coolant occur."

The means proposed by PSC in Reference 1a and updated in Reference 18, to shut down and cool down the reactor, consist of two trains (A and B) of post-fire shutdown systems which provide for reactivity control, PCRV integrity, and decay heat removal.

2.1.2.1 Reactivity Control

Reactor shutdown is accomplished by insertion of the 37 control rod pairs via a manually or automatically initiated reactor scram. A scram is accomplished by interrupting the power supply to the Control Rod Drive Mechanisms (CRDM's) and their associated holding brakes which allows the control rods to fall by gravity into the core. Two Wide Range Nuclear Instruments (one per train) are utilized to monitor the core reactivity. In addition, the FSV design includes a Reserve Shutdown System (RSS) which can be manually actuated to insert separate neutron absorbing material into the core for reactivity control. Use of the RSS is covered by FSV Interim Technical Specifications, LCO's 3.1.4 and 3.1.6.

Since (1) there is a high degree of assurance that sufficient neutron absorbing material can be inserted to make the reactor subcritical, (2) there will be little effect on core reactivity except for temperature changes, and (3) there are adequate provisions for monitoring the core reactivity, we find the reactivity control provisions to be acceptable.

2.1.2.2 PCRV Integrity

The shutdown models made the assumption that the integrity of the PCRV would be ensured by maintaining the decay heat removal function. PSC subsequently provided (in Reference 4) the results of a study which found that "the absence of liner cooling had no significant effect on maximum fuel or orifice valve temperatures while forced circulation cooling is functioning."

In addition to maintaining the structural integrity of the PCRV, the integrity of the various PCRV penetrations must also be maintained to control the primary coolant inventory. The majority of the penetrations are through the top head of the PCRV. These consist of 37 CRDM and purification system penetrations. Steam generator and helium circulator penetrations are located in the bottom head, and the safety valves and instruments penetrate the sidewalls. All penetrations have a double closure design and are relatively unaffected by fires from a loss of integrity viewpoint. A summary of the PSC evaluations is contained in Reference 1a, Section 2.1.

Based on the results of the above study, we find the PCRV integrity provisions to be acceptable.

2.1.2.3 Decay Heat Removal (DHR)

The post-fire shutdown model for DHR proposed in References 1a and 18 consists of two trains of components which provide for core heat removal, primary coolant inventory control, process monitoring, and secondary heat removal.

a. Core Heat Removal

- The post-fire shutdown model contains the following flow paths for core heat removal:

Train A - Condensate Pump 1C provides condensate flow from the Condensate Storage Tank through a steam generator to atmosphere for the first 5 hours after shutdown. Thereafter, the flow from the steam generator is recirculated through the DHR Exchanger. The Condensate Pump 1C also provides flow through a helium circulator.

Train B - The diesel driven fire water pump provides flow from the main cooling tower through a steam generator and a helium circulator. These flows are vented to the atmosphere and returned to the turbine building sump, respectively.

These flow paths are shown schematically in Figures 2.1-8 and 2.1-9 in Reference 18, copies of which are included in this evaluation as Attachments 1 and 2. A discussion of various aspects of these flow paths is contained in the following paragraphs.

1) The electrical power supplies utilized are the ACM diesel generator (DG) for Train A components and Emergency Diesel Generator (EDG) set B for Train B components. The use of the ACM DG was necessitated by the lack of sufficient separation between the A and B EDG electrical cables. The proposed ACM DG electrical flow path runs from the 4160 volt ACM bus to the HVAC switchgear bus, to its feeder supply at the Reserve Auxiliary Transformer, through the feeder to the 4160 volt switchgear Bus 2 where it can be cross-connected to either Bus 1 or 3. The 4160 volt buses provide power to their associated, essential, 480 volt buses (1, 2, and 3). The EDG's provide power directly to the associated 480 volt essential bus; EDG A to Bus 1, EDG B to Bus 3. (These flow paths can be seen on Figure 8.2-5 of the FSV FSAR.)

   The proposed means to provide electrical power are acceptable. The adequacy of procedures, testing and training will be verified during routine inspection activities.

2) The effectiveness of the flow paths through the steam generators in the proposed post-fire shutdown model was questioned in Reference 3. The requested analyses were submitted by PSC letters dated February 17, 1987 (P-87055), and May 1, 1987 (P-87158) (References 16 and 17). Based on a review of the available information, the conceptual designs of the flow paths are acceptable provided: (a) the above analysis verifies the effectiveness of the flow path, and (b) sufficient makeup water capability is demonstrated. The review of these analyses will be the subject of a separate Safety Evaluation.

3) The design of both Trains A and B utilizes the service water system. Train A includes the use of the DHR Exchanger to transfer the heat removed from the primary coolant in the steam generator to the service water system. A discussion of the service water system is contained in a subsequent subparagraph (d) on secondary heat removal.

4) Both post-fire shutdown trains provide for the operation of one Helium Circulator to transport the heat in the reactor core to the steam generators; Train A utilizes condensate flow directly, Train B utilizes fire water through the Emergency Water Booster Pump to drive the circulator's water turbine. A review of FSAR Section 14.4.2.1, indicates that "One helium circulator can provide nearly 4.5% of rated flow through the reactor core when operated by itself with condensate water supplied to this water-turbine drive." However, for Train B, operating on boosted fire water, approximately 3% of rated helium flow can be achieved. Based on this information (References 16 and 17), the primary flow requirement can be met.

The water used to drive the water turbine of the circulators discharges into the Turbine Water Drain Tank where it is removed by one of two Turbine Water Removal Pumps. The tank is common to both trains and the pumps are located approximately 5 feet apart; therefore, adequate separation is not maintained. However, the licensee has proposed to compensate for potential fire damage to both pumps by posting a fire watch (Reference 22). The adequacy of this procedure will be verified during future staff inspections.

PSC will permanently install a third Turbine Water Removal Pump a minimum of 50 feet from the existing tank and pumps. This pump will be used in normal plant operation and also meet the criteria of redundant Appendix R emergency shutdown equipment.

A review of the ability to operate the circulators with the proposed auxiliary equipment (see Attachment 3 for flow diagram) disclosed provisions for providing bearing water but not for providing a source of the buffer helium for shaft sealing. The PSC response (Reference 4, Item 8) addressing the acceptability of operating a circulator without buffer helium indicates that tests which were conducted showed that there would be little effect on either helium egress or water ingress. Therefore, the bearing water system is adequate.

The makeup source to the bearing water system is from the condensate tanks via the Emergency Bearing Water Makeup Pump for Train A and the normal Bearing Water Makeup Pump for Train B, both of which can be cross connected. While the makeup systems appear to be acceptable, the power supply cables lack the required separation. The licensee proposed modifications which will result in greater physical separation of the cables. These modifications have been reviewed and found acceptable as discussed in our evaluation of the exemption request for the Reactor Building (See Section 2.9).

b. Primary Coolant Inventory Control

Primary coolant inventory is controlled by maintaining PCRV integrity. A discussion of PCRV integrity is contained in Section 2.1.2.2, above.

c. Process Monitoring

The process monitoring function is required to confirm PCRV integrity, core heat removal and secondary heat removal.

1) PCRV Integrity Monitoring

PCRV integrity can be monitored by the use of primary coolant pressure and temperature indications, if available. PSC has, however, requested an exemption from monitoring PCRV integrity in their request for exemption from the requirements contained in Section III.G.2 of Appendix R for the reactor building. The basis for this exemption request is adequate.

2) Core Heat Removal and Secondary Heat Removal Monitoring

Core heat removal monitoring is proposed to be accomplished by monitoring primary coolant flow in conjunction with secondary heat removal monitoring (i.e., steam generator flow and exit temperature). Coolant flow is detected by monitoring the differential pressure across the circulator; the secondary heat removal is detected by monitoring feedwater flow and steam generator exit temperature and pressure. When questioned on the adequacy of this design, PSC responded (Reference 4, Item 15) that if primary flow could be confirmed, heat would be transferred to the helium as it passed through the core, and that monitoring steam generator flow, temperature, and pressure would verify decay heat removal. The feedwater flow instruments have a range of 0-1,200,000 lb/hr. and the condensate flow available is about 37 percent of the range. Thus, accurate flow measurement is possible.

In order to adequately monitor heat removal, PSC has proposed to only monitor the steam generator exit for constant or decreasing temperature at constant pressure. Since, the governing parameter for the heat removal process is to maintain adequate subcooling margin on the steam generator outlet, this proposal is acceptable.

In addition, the circulator flow instruments lack the required separation and are included in the reactor building exemption request. The adequacy of the proposed instrumentation has been addressed in the exemption request evaluation (see Section 2.9).

d. Secondary Heat Removal

As discussed above, secondary heat is removed in Train A through the use of the DHR Exchanger where the decay heat, which was transferred to the feedwater in the steam generators, is transferred to the service water system. The service water models are shown schematically in Figures 2.1-11A and 2.1-11B of Reference 18. These figures are included as Attachments 4 and 5.

1) The Train A service water (SW) system utilizes a SW pump to provide flow from the SW cooling tower through the SW strainer to the various system cooled components or "loads." The return path from these loads is back to the SW cooling tower where one of the SW cooling tower fans is operated to reject the heat to the atmosphere. Makeup flow to the SW cooling tower is provided from the domestic water supply. The SW pump and the tower fan can all be powered from the ACM DG.

2) The Train B SW system utilizes a circulating water pump to provide flow from the Main Cooling Tower to the SW system, through the various loads, and back to the tower. The licensee's evaluation of the need for operating a Main Cooling Tower Fan is contained in Reference 4, Item 5. This evaluation, performed before the DHR Exchanger heat load was deleted from the Train B model, concludes that cooling assistance is not required. If cooling is desired, either (a) makeup water may be added or (b) a fan may be operated.

3) PSC provided a discussion of single failure considerations for components common to both proposed trains of SW in Reference 4, Item 1. In particular, the SW strainer and the flow control valves to the various loads were addressed. Since these components are water-filled mechanisms which can be manually operated, their use was determined to be acceptable.

2.1.3 Implementation of Post-Fire Shutdown Model

The ability to physically implement the required flow paths for the post-fire shutdown trains discussed in the preceding section was also evaluated. This evaluation considered whether the flow paths were physically practical and if the flow paths could be established within the required time period.

2.1.3.1 Establishing Flow Paths

A review of numerous facility piping and instrumentation drawings (P&IDs) showed that the proposed flow paths were possible, but that numerous interconnections and alignments would be necessary.

In response (Reference 4, Item 2b) to questioning on why all valves necessary to complete the flow path were not included in the listings provided in Reference 1a, the licensee stated that only those manual valves whose positions are required to be changed were listed. Further PSC reviews did identify some additional manual valves which were added to the listings. (All power operated valves were checked, whether required to change position or not.) The plant procedures do not require a check of valve positions on a routine basis but only when returning a system to operation following an outage. A further discussion of the PSC position, contained in Reference 10, states that the existing controls are adequate and that controls over non-Technical Specification systems/components will be incorporated in the Fire Protection Program. The acceptability of the valve lineup surveillance will be evaluated during an NRC inspection.

The availability of the post-fire shutdown equipment will be demonstrated through the Fire Protection Operability Requirements submitted to the NRC on December 15, 1987, as part of the FSV Fire Protection Program Plan. PSC has proposed demonstrating the operability of post-fire shutdown trains in a simulated post-fire environment to the extent possible. Whether or not adequate testing and adequate walkdowns have been performed will also be determined during an NRC inspection.

2.1.3.2 Manual Actions and Timing

A concern was raised in Reference 3 that the numerous manual actions required to implement the post-fire shutdown models may require more manpower than would be available. The PSC response contained in Reference 4 (Items 12 and 13) concluded that all required manual actions could be accomplished within the required time limit of 90 minutes by the nine personnel required to be on shift. The response stated that although five personnel are dedicated to the Fire Brigade, the remaining four, operating independently for 85 minutes, could implement the post-fire shutdown model. It was noted that all actions were assumed to be mutually independent and that no supervision nor control room monitoring had been considered. PSC agreed to perform a more realistic assessment of the manpower requirements in Reference 5. PSC has now provided for ten personnel on shift and has made an assessment of the manning required to accomplish required manual actions for each fire area (Reference 11). This includes control room manning. Subject to confirmation through NRC inspection efforts that procedures and training are adequate, we conclude that the proposed staffing level is acceptable.

2.2 Exemption Request for Three Room Control Complex and Diesel Generator Rooms

2.2.1 Exemption Requested

The licensee requested exemptions from the technical requirements of Section III.G.2 of Appendix R to 10 CFR Part 50 in these areas to the extent that it requires that openings in 3-hour rated fire barriers be protected with similarly rated fire dampers, doors, and penetration seals.

2.2.1.1 Discussion (Three Room Control Complex)

The Three Room Control Complex has been considered as a single fire area. It houses the 480-volt switchgear room, the auxiliary electric equipment room, battery rooms, and the control room. The perimeter walls are constructed of reinforced concrete and have a 3-hour fire rating. They have unrated dampers designed to close automatically when the Halon fire suppression system actuates. Doors in the Control Room were originally UL-labeled, 3-hour fire door assemblies; however, hardware has been changed and security modifications have been made. As a result, these doors are not now considered 3-hour fire doors. The penetration openings in the Three Room Control Complex walls are sealed with both fire-rated and unrated penetration seals.

The walls feature some steel columns which are partially embedded within the walls. The exposed steel is unprotected inside the lower two rooms of the Three Room Control Complex proper. The steel columns in the control room itself are enclosed by concrete blocks. The steel columns are not an integral part of the concrete wall from the standpoint of structural integrity or fire rating. In the event of a fire, the vertical loads carried by these steel columns will be transferred to the concrete walls and down to the foundations.

Existing fire protection consists of halon and water spray fire suppression systems in the 480-volt switchgear and auxiliary electric equipment rooms; a halon fire suppression system in the control room, a partial fire detection system in the control room and area-wide fire detection systems in the rest of the Three Room Control Complex; and portable fire extinguishers and manual hose stations. In addition, automatic water spray systems exist along the "G" and "J" walls outside of the Three Room Control Complex. In Appendix R Evaluation Report No. 4, the licensee committed to repair the doors in the west wall of the Three Room Control Complex and to upgrade the seals in the west wall to be 3-hour fire rated.

2.2.1.2 Discussion (Diesel Generator Rooms)

The diesel generator rooms are considered as two separate fire areas. They are bounded by reinforced concrete walls and ceiling having a fire resistance rating of at least 3 hours. Several unrated dampers exist in the HVAC duct penetrations of these walls where they form a common boundary with the Turbine Building. The dampers were installed in conjunction with the existing carbon dioxide fire suppression system for each room and are designed to close when the system actuates. No unprotected penetrations exist in the common wall between the diesel generators. Existing fire protection includes fire detection systems, the above-referenced automatic fire suppression systems, portable fire extinguishers, and manual hose stations.

The licensee justifies the exemptions in these areas on the bases of the existing fire protection, the proposed modifications, and the ability to safely shut down the plant in the event of a fire.

2.2.3 Evaluation

The technical requirements of Section III.G are not met in these locations because the penetrations of the 3-hour fire barriers are not all protected by doors, dampers, or penetration seals that have a 3-hour fire rating. In addition, there exists some unprotected steel in the perimeter walls of the Three Room Control Complex.

We were concerned that in the event of a fire of significant magnitude, products of combustion would pass through the wall and damage redundant/alternate shutdown systems on the other side. However, the areas on both sides of these walls are protected by automatic fire detection systems as described in the Appendix R Evaluation Report. These systems alarm in the control room. We therefore expect that any potential fire would be detected in its incipient stages before significant flame spread or room temperature rise occurred. The plant fire brigade would then be dispatched and would put out the fire using manual fire fighting equipment.

If rapid fire spread occurred, the automatic fire suppression systems would actuate to control the fire and reduce the rise in ambient temperature. Until this occurred, the existing walls which surround these areas would act to confine the effects of the fire to the area of origin.

Because openings exist in the walls, we expect a quantity of smoke and hot gases to pass through them and enter the adjoining locations. But the smoke would be so dissipated and the hot gases would be cooled to the point where, in our judgment, they would not represent a significant threat to post-fire shutdown systems outside of the fire area.

2.2.4 Conclusion

Based on our evaluation, we conclude that the licensee's alternate fire protection configuration, with the proposed modifications, will achieve an acceptable level of fire safety equivalent to that provided by Section III.G.2. Therefore, the licensee's request for exemption for a complete 3-hour fire barrier in the Three Room Control Complex and Diesel Generator Rooms should be granted.

2.3 Exemption Request for Control Room

2.3.1 Exemption Requested

The licensee requested an exemption from the technical requirements of Section III.G.3 of Appendix R to 10 CFR Part 50 to the extent that it requires that a fire detection system be installed throughout a fire area that has been provided with an alternate shutdown capability.

2.3.2 Discussion

The control room is a separate room within the Three Room Control Complex. It is bounded by walls that have a 3-hour fire rating, except for the doors, dampers, and penetration seals which are evaluated in Section 2.2.

The principal fire hazard within the area consists of cable insulation and paper. Existing fire protection includes an areawide halon fire suppression system, fire detectors in the control room cabinets and consoles, portable fire extinguishers, and manual hose stations.

The licensee justifies the exemption on the basis of the existing protection, the continuous presence of control room operators, and the ability to safely shut down the plant after the fire, independent of the Three Room Control Complex.

2.3.3 Evaluation

The technical requirements of Section III.G are not met in this location because of the absence of a fire detection system that provides areawide coverage.

We were concerned that because of the absence of an areawide fire detection system, a fire could develop which would damage post-fire shutdown systems to the extent that the plant could not be safely shut down after the fire. However, the control room is continuously manned and automatic smoke detectors are located in the control room cabinets and consoles. We, therefore, have reasonable assurance that a fire would be detected and suppressed by the control room operators or the plant fire brigade early, before significant damage occurred.

If a serious fire developed, the existing halon fire suppression system would be manually actuated to put out the fire or control it until the plant fire brigade arrived.

If such a fire caused the loss of redundant post-fire shutdown systems, the Alternate Cooling Method is available to bring the plant to a safe shutdown condition. This ACM capability is physically and electrically independent of the Three Room Control Complex. Therefore, an areawide fire detection system in the control room is not necessary to provide us with reasonable assurance that a fire would be detected and post-fire shutdown capability maintained free of fire damage.

2.3.4 Conclusion

Based on our evaluation, we conclude that the licensee's alternate fire protection configuration provides an acceptable level of fire safety equivalent to that provided by Section III.G.3. Therefore, the licensee's request for exemption for an areawide fire detection in the control room should be granted.

2.4 Exemption Request for Turbine Building

2.4.1 Exemption Requested

The licensee requested an exemption from the technical requirements of Section III.G.2 of Appendix R to 10 CFR Part 50 to the extent that it requires that a fire detection system be provided throughout a fire area.

2.4.2 Discussion

The Turbine Building houses the secondary plant equipment including such components and systems as the turbine generator, main condenser; steam, condensate, and feed systems; HVAC systems; and the emergency water booster pumps.

The building is essentially a three-level structure, except for the access control bay portion. It is constructed of insulated dual corrugated steel walls and a metal deck-type roof.

The principal fire hazards in the building consist of accumulations of lube oil, hydraulic oil, hydrogen gas, and cable insulation. However, the locations which contain the largest concentration of these hazards are separated from the rest of the building by 2- or 3-hour fire-rated walls and ceilings, are protected by automatic fire suppression systems, or both.

Existing fire protection includes partial fire detection and fire suppression systems, as discussed in Appendix R Evaluation Report No. 4, manual hose stations, and portable fire extinguishers. In Report No. 4, the licensee committed to modify and extend the existing fire detection system detectors throughout the area of the first two levels of the turbine building and at elevation 4846 feet 6 inches of the access control bay. The fire detection system will be in accordance with the provisions of National Fire Protection Association (NFPA), Standard No. 72E.

The licensee justifies this exemption on the basis of the existing fire protection, the proposed modifications, and the fact that there are no post-fire shutdown systems in those locations where no fire detectors will be provided.

2.4.3 Evaluation

The technical requirements of Section III.G.2 are not met in this location because redundant, post-fire shutdown systems are not separated by more than 20 feet, free of intervening combustibles. In addition, automatic fire suppression and detection systems are not provided throughout this area. Our evaluation of the separation and fire suppression issues is contained in Sections 2.5 and 2.10 of this report.

Our principal concern with this exemption was that because of the absence of an areawide fire detection system, a fire of significant magnitude could develop and damage systems needed to safely shut down the plant. However, a fire detection system that meets the requirements of NFPA Standard No. 72E will be installed at every elevation of this fire area that does contain post-fire shutdown systems. If a fire should occur in these locations, we expect it to be detected by the system. An alarm would be transmitted automatically to the control room and the fire brigade would subsequently be dispatched. The brigade would put out the fire using manual fire fighting equipment.

If fire should break out on the operating floor or the upper elevations of the Access Control Bay, we expect it to be discovered, after some time delay, by plant operators or the security force. Until the arrival of the fire brigade, there are no post-fire shutdown systems that could be damaged by fire in these locations. Therefore, an areawide fire detection system is not necessary to provide reasonable assurance that the post-fire shutdown capability will remain free of fire damage.

2.4.4 Conclusion

Based on our evaluation, we conclude that the licensee's alternate fire protection configuration, with the proposed modifications, will achieve an acceptable level of fire safety equivalent to that provided by Section III.G.2. Therefore, the licensee's request for exemption for an areawide fire detection system in the Turbine Building should be granted.

2.5 Exemption Request for Access Control Bay

2.5.1 Exemption Requested

The licensee requested an exemption from the technical requirements of Section III.G.2 to the extent that it requires that redundant post-fire shutdown systems be separated by 20 feet free of intervening combustible materials or by a 1-hour fire barrier and that the area be protected by an automatic fire suppression system and a fire detection system.

2.5.2 Discussion

The Access Control Bay is a multi-level structure which is part of the larger Turbine Building Fire Area. It extends upward from elevation 4846 feet, 6 inches to the roof at elevation 4938 feet 0 inches.

Three reinforced concrete floors and one partial steel grating floor further subdivide the Access Control Bay above elevation 4846 feet 6 inches. Within this structure, the licensee has identified redundant reactor plant exhaust fans, on elevation 4846 feet 6 inches, that are not protected per the requirements of Section III.G. The fans are separated from each other by about 18 feet, and there are no intervening combustibles.

The fire hazard in the Access Control Bay consists of charcoal, lubricating oil, and cable insulation which represent a fire load of about 20,750 BTU/sq. ft. This quantity of combustibles, if totally consumed, would produce an equivalent fire severity of about 16 minutes as determined by the ASTM E-119 time-temperature curve.

Existing fire protection includes manual hose stations, portable fire extinguishers and automatic fire suppression over the charcoal filters. In Appendix R Evaluation Report No. 4, the licensee committed to install an automatic fire detection system on elevation 4846 feet 6 inches of the Access Control Bay. The system will be in accordance with the provisions of NFPA Standard No. 72E. In addition, the licensee proposed to relocate cables and transfer switches to the Train A fan so that the switches are located at least 35 feet away from its redundant Train B switch and cables are routed to each of the fans to enter from opposing directions and thereby obtain the maximum separation from the redundant cables of the opposite train.

The licensee justified this exemption on the basis of the existing fire protection and the proposed modifications. In addition, the licensee indicated that should these fans be damaged by a fire, alternate cooling is available through a chiller unit and recirculation fan that are located in another fire area.

2.5.3 Evaluation

Although the licensee requested an exemption from Section III.G.2, the requirements of Section III.G.3 apply because of the availability of the alternative Reactor Building cooling capability. The requirements of Section III.G.3 are not met in the Access Control Bay because of the absence of an areawide fixed fire suppression system.

Our principal concern with the level of fire safety in this location was that because of the relative proximity of the reactor plant exhaust fans, a fire of significant magnitude would damage redundant post-fire shutdown systems to such an extent that safe shutdown could not be achieved and maintained.

However, the fire load in this location is not significant and the combustible materials are dispersed throughout the elevation. If a fire should occur, it would be detected by the fire detection system in its incipient stages before significant flame propagation or room temperature rise occurred. The alarm would be automatically transmitted to the control room. The fire brigade would then be dispatched and would put out the fire using manual fire fighting equipment. Pending arrival of the brigade, the effects of the fire would be mitigated because the smoke and hot gases would rise up into the high ceiling area, which would tend to act as a heat sink. Also, the fan motors and related cables would be shielded from the effects of a fire by the metal fan enclosures. Nevertheless, if a fire did damage both reactor plant exhaust fans, the licensee will be able to recover from this damage by relying upon a chiller unit and recirculation fan that is located in a separate fire area. Therefore, the fixed fire suppression system is not necessary to provide reasonable assurance that safe shutdown can be achieved and maintained.

2.5.4 Conclusion

Based on our evaluation, we conclude that the licensee's alternate fire protection configuration, plus the proposed modifications, will achieve an acceptable level of fire protection equivalent to that provided by Section III.G. Therefore, an exemption for the absence of a fixed fire suppression system in the Access Control Bay should be granted.

2.6 Exemption Requests for Outside Areas-Exterior Routing and Turbine Reactor Buildings-Common Wall

2.6.1 Exemption Requested

The licensee requested an exemption from the technical requirements of Section III.G.2 of Appendix R to 10 CFR Part 50 in these locations to the extent that it requires a 3-hour fire barrier to separate redundant/alternate shutdown related systems in separate fire areas.

2.6.2.1 Discussion (Outside Areas-Exterior Routing)

The Alternate Cooling Method (ACM) diesel and certain ACM-related components are relied upon as the emergency power source for post-fire shutdown Train A. The ACM diesel, transformers, plant 4-kV switchgear, 4-kV HVAC switchgear, 4160/480-volt transformers, reserve auxiliary transformer bus, and ACM 4-kV switchgear are located outside of the Turbine Building. There is also ACM equipment located in the Evaporative Cooler Building, east of the Turbine Building near its southeast corner. ACM equipment in this building consists of the ACM batteries, ACM motor control center, and ACM 480-volt load center.

The Turbine Building contains the emergency diesel designated as the emergency power supply for post-fire shutdown Train B. Cabling and components associated with post-fire shutdown Train B are located within the Turbine Building.

Cabling from the ACM diesel feeding the 4-kV switchgear, and then routed to the 4160/480-volt transformers, is used as the emergency backfeed to load centers in the Three Room Control Complex to serve as the power supply for post-fire shutdown Train A. The cable routings up to the 4160/480-volt transformers are routed underground, with the exception of overhead bus duct feeds between the 4-kV HVAC switchgear, reserve auxiliary transformer, and the plant 4-kV switchgear. Feeds from the transformers into the Three Room Control Complex are open, ventilated, bus ducts routed above ground. These feeds pass along the east side of the Turbine Building wall.

The 4-kV switchgear is located south of the Turbine Building in the vicinity of the diesel generator rooms. The south wall of the diesel generator rooms is reinforced concrete construction. The 4-kV switchgear is located inside a separate metal enclosure that is accessed from the yard area. The 4-kV switchgear enclosure is located approximately 8 feet south of the Turbine Building with open space in-between. Cabling within the 4-kV switchgear enclosure enters from underground.

The reserve auxiliary transformer bus duct is also used as part of this ACM backfeed. The reserve auxiliary transformer is located outside, approximately 20 feet from the Turbine Building. The closest post-fire shutdown Train B component is the Train B emergency diesel generator. The emergency diesel generator room is a separate fire area, and is separated from the outside by a reinforced concrete wall.

An HVAC switchgear enclosure associated with ACM is also located south of the Turbine Building, 7.5 feet from the building but more than 30 feet from the nearest post-fire shutdown components within the Turbine Building.

ACM components in the Evaporative Cooler Building are used as part of post-fire shutdown Train A. The Evaporative Cooler Building is a separate fire area, since it is a separate building with exterior walls to the outside. This building is separated from the Turbine Building by approximately 10 feet of open space, free of intervening combustibles.

Other components in the yard area associated with the ACM, when used for the Train A emergency power supply, are the ACM diesel, ACM transformer, and the ACM 4-kV switchgear. These structures are located more than 100 feet east of the Turbine Building.

2.6.2.2 Discussion (Turbine/Reactor Buildings-Common Wall)

The Turbine Building and Reactor Building are considered as two separate fire areas. The common wall between these two areas is constructed of corrugated steel. All openings in this wall are sealed so as to maintain the pressure differential required for the Reactor Building. Redundant shutdown post-fire equipment that is located on both sides of the wall and is separated by at least 35 feet. Existing fire protection includes fire detection and fire suppression systems, manual hose stations, and portable fire extinguishers, as described in Appendix R Evaluation Report No. 4.

The licensee justifies the exemptions on the basis of the existing fire protection, the spatial separation between post-fire shutdown systems, and the ability of the non-rated walls to provide a degree of passive fire protection until any potential fire is extinguished.

2.6.3 Evaluation

The technical requirements of Sections III.G.2 and III.G.3 are not met in these locations because normal post-fire shutdown systems are not separated from their redundant counterparts or the systems associated with the alternate cooling method by a 3-hour fire-rated barrier.

Our principal concern was that a fire of significant magnitude may result in damage to components associated with the normal post-fire shutdown systems and the alternate cooling method.

If a fire were to occur in the above-referenced outside locations, a potential exists for components associated with the ACM to be damaged. However, because these areas are located outside and away from the normal post-fire shutdown systems located within the Turbine Building, we do not expect the products of combustion or radiant energy from such a fire to affect the normal post-fire shutdown systems. Smoke and hot gases would tend to be dissipated in the open air. Radiant energy would be mitigated by the intervening open space and by the exterior walls of the Turbine Building.

Similarly, if a fire were to occur inside the Turbine or Reactor Buildings, we expect the fire to be detected by the automatic fire detection systems, plant operators, or the security force. The fire would either be extinguished manually by the plant fire brigade or by the automatic fire suppression systems. Because these locations are large open plant areas, the smoke and hot gases from such a fire might spread within each area. But it is our judgment that the metal and masonry walls which bound these fire areas are capable to a significant extent of confining the effects of the fire to the immediate fire area, until the fire is extinguished. Because these walls are not all fire-rated, some products of combustion may spread beyond them. However, the smoke and hot gases would be cooled and dissipated so that there will be no threat to the redundant/alternate post-fire shutdown systems in the adjoining fire areas. Therefore, complete 3-hour fire-rated walls are not necessary to provide reasonable assurance that post-fire shutdown conditions could be achieved and maintained with undamaged systems in the other fire areas.

2.6.4 Conclusion

Based on our evaluation, we conclude that the licensee's alternate fire protection configuration will achieve an acceptable level of fire safety equivalent to that achieved by compliance with Sections III.G.2 and III.G.3. Therefore, the licensee's request for exemption for a 3-hour fire wall between the Turbine Building and the Reactor Building and outside areas should be granted.

2.7 Exemption Requests for Alternate Cooling Method/Congested Cable Area Interface

2.7.1 Exemption Requested

The licensee requested an exemption from the technical requirements of Section III.G.2 of Appendix R to 10 CFR Part 50 to the extent it requires that redundant post-fire shutdown-related systems be separated by more than 20 feet free of intervening combustibles and the area be protected by automatic fire detection and suppression systems.

2.7.2 Discussion

Cabling associated with post-fire shutdown components passes through the congested cable areas (CCA) outside of the "J" and "G" walls for the Three Room Control Complex and then into the Three Room Control Complex. For a fire at these locations, safe shutdown would be achieved using systems associated with the ACM. In general, ACM components and cabling are located in other fire areas outside of the Reactor and Turbine Buildings. Most of the cables and components for the ACM that are located in the Reactor and Turbine Buildings are located more than 40 feet away from the congested cable area. For those systems that are located less than 40 feet from the CCA, described in Appendix R Evaluation Report No. 4, the licensee has identified other systems that could be employed to achieve safe shutdown.

The principal fire hazard in these ACM CCA interface areas is cable insulation. However, the areas of concentrated quantities of cables are protected by automatic sprinkler systems. In addition, these locations are protected by fire detection systems and are provided with portable fire extinguishers and manual hose stations.

The licensee justified this exemption on the basis of the existing fire protection, the spatial separation between post-fire shutdown systems, and the availability of a number of systems that could be relied upon to achieve and maintain safe shutdown after a fire.

2.7.3 Evaluation

The technical requirements of Section III.G are not met in these locations because the alternate shutdown capability is not physically and electrically independent of the fire area.

Our principal concern with the level of fire safety in these locations was that a fire of significant magnitude might damage systems associated with both the manual shutdown capability and the alternate cooling method. There is no major unmitigated fire hazard in these locations. The only significant hazard which would represent a threat to shutdown systems is the concentration of combustible insulation on the cables. However, these cable concentration areas are protected by automatic sprinkler systems. The suppression systems along the "G" and "J" walls were originally designed for manual actuation. However, at our request, the licensee converted these systems to automatic actuation. We acknowledged that this conversion would not completely conform to the guidelines of NFPA Standards 13 and 15. But, it was our judgment that an automatic system would achieve a higher level of protection.

The interface areas will be protected by an automatic fire detection system that meets the requirements of NFPA Standard No. 72E. As a result, we expect any potential fire to be detected early, before significant fire propagation or room temperature rise occurs. The fire would then be extinguished by the plant fire brigade using manual fire fighting equipment. If rapid fire spread occurred, we expect the automatic wet pipe sprinkler systems to actuate and limit fire spread, moderate room temperature rise, and protect the post-fire shutdown cables along the "G" and "J" walls. Until the arrival of the fire brigade, the spatial separation between post-fire shutdown systems provides passive protection to prevent damage to redundant/alternate post-fire shutdown systems. For those systems which are not sufficiently separated, the licensee has identified alternate means of achieving and maintaining safe shutdown that would not be affected by a fire.

2.7.4 Conclusion

Based on our evaluation, we conclude that the licensee's alternate fire protection configuration will achieve an acceptable level of fire safety equivalent to that achieved by compliance with Section III.G. Therefore, the licensee's request for exemption in the ACM CCA Interface Areas should be granted.

2.8 Exemption Request for Emergency Lighting

2.8.1 Exemption Requested

The licensee requested an exemption from the technical requirements of Section III.J of Appendix R to 10 CFR Part 50 to the extent that it requires emergency lights to be powered by individual 8-hour battery packs.

2.8.2 Discussion

The plant is presently equipped with hard-wired, essential/emergency backup lighting systems powered from the standby diesel generators and the plant DC system. However, these systems are not sufficiently independent so that they would be available in the event of a fire.

In Appendix R Evaluation Report No. 4, the licensee committed to install a new system for the Reactor and Turbine Buildings. Outlying structures requiring access for post-fire shutdown functions that are not covered by ACM-powered lights will be covered by 8-hour battery lights. The new emergency lighting system will have the following attributes:

1. Wiring and lights configured so that multiple physically separate systems would result with each system covering a zone or quadrant. Lighting equipment in each zone will be separated by a minimum of 30 feet from that of another zone. Loss of any one zone because of a postulated fire would be compensated for by the lights in the adjacent zones, including permanently installed but movable "extension lights" where necessary;

2. Separate and independent power feeds for each zone covered;

3. Electrical power supplied from the ACM diesel;

4. Breaker coordination so that only one circuit would fail given the loss of any one individual light unit, or a single fault such as due to a fire;

5. A minimal number of lights per circuit so that the lighting availability loss would be minimized given a circuit loss;

6. A mix of local area lights and spot flood beams plus extension lights where necessary;

7. Receive a field check/walkdown to confirm adequate numbers, locations, and positioning of lights.

Essential valve operators or equipment components requiring manual operator action(s) will be covered by local zone lighting and/or spot beams. Therefore, if a fire failed the local circuit, the spot beams from a distance greater than 30 feet would still be functional. In addition, extension lights will be available in selected areas where valves are located in upper galleries.

The licensee justifies this exemption on the bases that the proposed new lighting system provides an equivalent level of emergency lighting to individual 8-hour battery packs.

2.8.3 Evaluation

The technical requirements of Section III.J are not met in the Reactor and Turbine Buildings because the new emergency lights are not powered by individual 8-hour batteries.

We had two concerns with the proposed emergency lighting system in these buildings. The first was that a sufficient number of lights would not be installed so as to provide an adequate level of illumination. However, all essential valves and equipment components requiring manual operator actions, and access and egress routes thereto, will be covered by the local zone lighting and/or spot beams. In addition, at our request, the licensee in Appendix R Evaluation Report No. 4, committed to verify the adequacy of the illumination by conducting a field walkdown with plant operators to confirm the adequacy of the numbers, locations, and positioning of the lights.

The second concern was that a fire could damage the power supply to the emergency lighting. However, the new system is designed in such a manner that a fire in any one zone would not affect the emergency lighting in adjacent zones. Therefore, individual 8-hour batteries for each emergency light are not necessary to provide reasonable assurance that sufficient emergency lighting would be available to complete post-fire shutdown functions.

2.8.4 Conclusion

Based on our evaluation, we conclude that the licensee's alternate configuration will achieve an acceptable level of safety, equivalent to that achieved by compliance with Section III.J. Therefore, the licensee's request for exemption for individual 8-hour battery powered emergency lighting in the Reactor and Turbine Buildings should be granted.

2.9 Exemption Request for Reactor Building

2.9.1 Exemption Requested

The licensee requested an exemption from the technical requirements of Section III.G.2 of Appendix R to 10 CFR Part 50 to the extent that it requires that redundant post-fire shutdown systems be separated by 20 feet free of intervening combustibles and be protected by automatic fire detection and suppression systems.

2.9.2 Discussion

The Reactor Building is a single fire area. It contains redundant components and cables associated with the turbine water removal pumps, bearing water pumps, primary coolant and steam generator instrumentation. It also contains Train A components and cables associated with the emergency bearing water makeup pump and Train B components and cables associated with the bearing water makeup pump.

The principal fire hazard in this location consists of hydraulic oil associated with the hydraulic power units and over the helium circulator-turntable. Additional combustible materials include lubricating oil and combustible cable insulation.

Existing fire protection includes automatic sprinkler systems for the hydraulic oil fire hazards and cable concentration areas, manual hose stations, and portable fire extinguishers. In Appendix R Evaluation Report No. 4, the licensee committed to install a fire detection system to provide areawide coverage of the Reactor Building below the refueling floor in a manner that reflects the potential problem of smoke stratification. The licensee also committed to reroute certain post-fire shutdown cables to achieve at least 50 feet of horizontal separation or 30 feet of separation if an intervening floor exists between redundant systems except as identified and evaluated in this Safety Evaluation. A third turbine water removal pump, permanently installed a minimum of 50 feet from the existing tanks and pumps, will also be provided to compensate for the potential loss of redundant turbine water removal pumps on elevation 4740 feet 6 inches.

The licensee justified the exemption on the existing fire protection, the proposed modifications, and the spatial separation between redundant post-fire shutdown systems.

2.9.3 Evaluation

The technical requirements of Section III.G.2 are not met in the Reactor Building because the intervening space between redundant post-fire shutdown systems contains some combustible material. In addition, the fire detection system does not extend to the refueling floor and above, and the existing sprinkler systems do not provide areawide coverage.

Our principal concern was that a fire of significant magnitude would damage systems associated with redundant post-fire shutdown methods. However, the major fire hazards in this area are covered by an automatic fire suppression system. Consequently, a fire involving these hazards would be mitigated by the system. Remaining combustible materials are generally dispersed throughout the remainder of the area. As a result, a fire involving these materials would be of limited magnitude and extent and would be characterized, initially, by low flame propagation and ambient temperature rise.

If a fire did occur, it would be detected early by the fire detection systems. Where no detectors have been provided above the refueling floor, no shutdown systems exist. Upon actuation of the detection system or discovery of the fire by plant personnel, the control room would be notified and the fire brigade dispatched. The fire would then be either suppressed manually, using portable fire fighting equipment, or automatically, if the fire originated in the sprinkler area. Until the fire is controlled, the spatial separation between post-fire shutdown systems, which in part extends over more than one floor elevation, will provide reasonable assurance that a post-fire shutdown capability will remain free of fire damage.

2.9.4 Conclusion

Based on our evaluation, we conclude that the licensee's alternate fire protection configuration, with the committed modifications, will provide an acceptable level of fire safety, equivalent to that achieved by compliance with Section III.G.2. Therefore, the licensee's request for exemption in the Reactor Building should be granted.

2.10 Exemption Request for Turbine Building

2.10.1 Exemption Requested

The licensee requested an exemption from the technical requirements of Section III.G.2 of Appendix R to 10 CFR Part 50 to the extent that it requires that the redundant post-fire shutdown systems be separated by more than 20 feet of intervening combustibles and be protected by automatic fire detection and suppression systems.

2.10.2 Discussion

The Turbine Building houses the secondary plant equipment including such components and systems as the turbine generator, main condenser, steam, condensate and feed systems, HVAC systems, and the emergency water booster pumps.

In Table 3.11-1 of the Appendix R Evaluation Report No. 4, the licensee identified the post-fire shutdown systems which do not meet the separation requirements of Section III.G. The licensee committed to either: 1) reroute fire-vulnerable cables outside of the fire area, or 2) protect one post-fire shutdown train by a 1-hour fire barrier, or 3) reroute fire-vulnerable cable to achieve at least 30 feet of horizontal separation with some intervening cables from its redundant alternate counterpart. For any other fire-vulnerable cables or systems, the licensee has identified a redundant means of achieving post-fire shutdown if these systems were lost because of a fire.

The licensee justifies the exemption on the bases of the existing fire protection, the proposed modifications, the spatial separation between post-fire shutdown systems, and the availability of a number of different systems that would be relied upon to achieve and maintain post-fire shutdown conditions.

2.10.3 Evaluation

The technical requirements of Section III.G are not met in this area because redundant post-fire shutdown systems are not separated by more than 20 feet free of intervening combustibles. In addition, automatic fire suppression and detection systems are not provided throughout the area. We evaluated the lack of areawide fire detection in Section 2.4 of this safety evaluation.

Our principal concern was that a fire of significant magnitude would damage systems associated with redundant post-fire shutdown methods. However, the major fire hazards in this area are covered by an automatic fire suppression system, or are separated by fire walls, or both. Consequently, a fire involving these hazards would be mitigated by the protection. Remaining combustible materials are generally dispersed throughout the remainder of the area. As a result, a fire involving these materials would be of limited magnitude and extent and would be characterized, initially, by low flame propagation and ambient temperature rise.

If a fire did occur, it would be detected early by the fire detection system. Where no detectors have been provided, no post-fire shutdown systems exist. Upon actuation of the detection system or discovery of the fire by plant personnel, the control room would be notified and the fire brigade dispatched. The fire would then be either suppressed manually, using portable fire fighting equipment, or automatically, if the fire originated in a sprinkler area. Until the fire is controlled, the spatial separation between post-fire shutdown systems, which in part extends over more than one floor elevation, will provide reasonable assurance that a post-fire shutdown capability will remain free of fire damage.

2.10.4 Conclusion

Based on our evaluation, we conclude that the licensee's alternate fire protection configuration with the committed modifications, will provide an acceptable level of fire safety, equivalent to that achieved by compliance with Section III.G.2. Therefore, the licensee's request for exemption in the Turbine Building should be granted.

2.11 Building 10

Building 10 is a new structure, erected subsequent to our "Appendix A" fire protection evaluation. It is located east of the Control Complex and is connected with it by a bridgelike walkover structure. The exterior walls are constructed of reinforced concrete. The floors are concrete on earth or concrete on metal panels. The roof is constructed of concrete on metal panels. The building has been divided into six fire areas occupied for offices, computer rooms, electrical and mechanical equipment rooms, and related areas. Fire protection includes fire detection systems, halon fire suppression systems, and portable fire extinguishers.

In Appendix R Evaluation Report No. 4, the licensee identified one deviation from the technical requirements of Section III.G.2 of Appendix R to 10 CFR Part 50. The licensee requested approval of an exemption from these requirements to the extent that they require that structural steel which is part of a fire barrier be protected so as to achieve a fire rating equivalent to the rating of the boundary. The structural steel is part of a 3-hour fire wall that separates two rooms that contain redundant post-fire shutdown systems. The licensee justifies the exemption on the basis of the low fire loading and the existing automatic fire protection.

The rooms on both sides of this wall are equipped with an automatic fire detection system. If a fire should occur, it would be detected in its formative stages before significant temperature rise occurs. The fire would then be put out manually using portable fire extinguishers. If rapid fire spread occurred, we expect the automatic fire suppression system to actuate to control the fire. The system has sufficient extinguishing agent for a manually initiated second discharge if the fire was not completely extinguished after the first discharge. Until the fire is extinguished, and considering the low fire loading (equivalent to a 15-minute duration on the ASTM E-119 time temperature curve), it is our judgment that the unprotected steel will remain undamaged and the integrity of the fire wall will be maintained. We, therefore, conclude that the licensee's fire protection configuration will provide an equivalent level of fire safety to that achieved by compliance with Section III.G. Therefore, the licensee's request for exemption for unprotected structural steel should be granted.

At our request, the licensee also submitted, in Report No. 5, dated May 1985, a comparison of the fire protection for Building 10 to the guidelines of Appendix A to BTP APCSB 9.5-1. The licensee has indicated that the guidelines pertaining to the provision of a standpipe system, yard hydrant, fire hose, and related equipment are not applicable to Building 10. We were concerned that in the event of a fire in those areas not protected by an automatic suppression system, the licensee would not have a readily available means to apply water from hose streams onto the fire. However, the fire brigade would be able to bring hoses from either stations in the turbine building or a yard hydrant near the building. The licensee has confirmed this capability by test. On this basis, we consider this issue closed.

In the trip report dated September 12, 1983 which documented the results of an NRC site audit, we stated that the licensee did not have within its organization or as a consultant a qualified fire protection engineer responsible for the formulation and implementation of the fire protection program. However, by letter dated October 16, 1986 (Reference 21), the licensee informed the staff of the addition of a fire protection engineer to the PSC staff. He is responsible for the development of the Fire Protection Program Plan and is the Program Manager of the Fire Protection Program. On this basis, the staff considers this issue closed.

2.12 <u>Licensee Comments</u>

By letter dated January 16, 1987 (Reference 19), the licensee provided comments regarding the staff's November 18, 1986 draft safety evaluation. In general, these comments have been reflected in the final safety evaluation. However, the staff's description of the licensee's commitment regarding the proposed emergency lighting system for the reactor and turbine buildings remain the same as in the original draft. The licensee was concerned that the staff has interpreted the commitment to provide separate and independent power <u>feeds</u> for each emergency lighting zone to mean that independent power <u>sources</u> will be provided. The staff recognizes that the alternate cooling method (ACM) diesel will be the only source of power for the new emergency lighting system. The power feeds to the individual zones will, however, be designed such that no two adjacent zones will be affected by any fire. The staff finds this concept acceptable, and no further clarification to the draft safety evaluation is necessary.

3.0 ENVIRONMENTAL CONSIDERATIONS

Pursuant to 10 CFR 51.30, the staff concludes the following about the listed factors:

(1) The need for the proposed actions is described above;

(2) The alternative to the exemptions would be to require literal compliance with Section IV.F. of Appendix E to 10 CFR Part 50. Such an action would not enhance the protection of the environment and would be adverse to the public interest generally;

(3) The issuance of the exemptions, or their denial, would not affect the environmental impact of the facility; and

(4) No consultation with other agencies or persons is needed.

Based on the above assessment, the NRC staff concludes, pursuant to 10 CFR 51.32, that the issuance of these exemptions will have no significant impact on the environment (52 FR 36319, September 28, 1987).

4.0 CONCLUSIONS

4.1 Post-Fire Shutdown Systems

The concepts submitted by the licensee for providing post-fire shutdown under fire considerations are adequate and therefore, acceptable. The remaining aspects identified herein will be addressed during inspection activities, and in confirmatory analyses as discussed in Section 4.3.

4.2 Exemptions

Based on our evaluation, we conclude that the licensee's existing fire protection configuration, with the proposed modifications, achieves an equivalent level of safety to that attained by compliance with Sections III.G and III.J. Therefore, the licensee's request for exemptions in the following areas should be granted:

1. Three Room Control Complex (Fire Barriers)
2. Control Room (Fire Detectors)
3. Turbine Building (Fire Detectors)

4. Building 10 (Structural Steel)

5. Access Control Bay (Separation Requirements)

6. Exterior routing of shutdown cabling

7. ACM CCA Interface Areas (Separation Requirements)

8. Common Wall-Turbine Building/Reactor Building

9. Reactor Building (Separation Requirements)

10. Turbine Building (Separation Requirements)

11. Diesel Generator Rooms (Fire Barriers)

12. 8-hour battery pack emergency lighting

4.3 Confirmatory Evaluations

As noted in Section 2.1.2.3(a)(2), PSC has submitted analyses addressing the effectiveness of the flow paths through the steam generators (for decay heat removal). The staff has requested it's contractor, Oak Ridge National Laboratory, to review these analyses. These evaluations will be considered confirmatory and will be reported in a separate Safety Evaluation.

Dated: May 10, 1988

Reviewers: D. Kubicki, DPWRL-B, NRR
R. Ireland, Region IV
R. Mullikin, Region IV

Attachments:
1 Figure 2.1-8
2. Figure 2.1-9
3. Figure 2.1-10
4. Figure 2.1-IIA
5. Figure 2.1-IIB

References

1. Appendix R Evaluation:

   a. Report No. 1, Shutdown Model, November 16, 1984 (Rev. 6)
   b. Report No. 2, Electrical Reviews, December 17, 1984 (Rev. 4)
   c. Report No. 3, Fire Protection, January 17, 1985 (Rev. 4)
   d. Report No. 4, Exemptions and Modifications, April 1, 1985 (Rev. 2)

2. Fire Hazards Analysis and Evaluation of Building 10 to the BTP 9.5-1 Appendix A Guidelines, Report No. 5, May 31, 1985 (Rev. 1).

3. NRC letter, Butcher to Lee, dated November 1, 1985.

4. PSC letter, Walker to Berkow, dated December 20, 1985 (P-85488).

5. PSC letter, Walker to Berkow, dated March 14, 1986 (P-86209).

6. PSC letter, Walker to Berkow, dated April 4, 1986 (P-86266).

7. License Amendment No. 14 with NRC letter, Denise to Walker, dated June 18, 1976.

8. License Amendment No. 18 with NRC letter, Denise to Fuller, dated October 28, 1977.

9. License Amendment No. 21 with NRC letter, Cammill to Millen, dated June 6, 1979.

10. PSC letter, Warembourg to Berkow, dated May 15, 1986 (P-86307).

11. PSC letter, Williams to Berkow, dated July 15, 1986 (P-86462).

12. PSC letter, Gahm to NRC (LER 86-020), dated August 11, 1986 (P-86513).

13. NRC letter, Wagner to Lee, dated June 4, 1984.

14. PSC letter, Lee to Johnson, dated August 17, 1984 (P-84281).

15. NRC letter, Crutchfield to Williams, dated August 3, 1987.

16. PSC letter, Brey to Berkow, dated February 17, 1987 (P-87055).

17. PSC letter, Brey to Calvo, dated May 1, 1987 (P-87158).

18. PSC letter, Warembourg to Calvo, dated May 15, 1987 (P-87167).

19. PSC letter, Williams to Berkow, dated January 16, 1987 (P-87013).

20. PSC letter, Williams to Calvo, dated December 15, 1987 (P-87422).

21. PSC letter, Williams to Berkow, dated October 16, 1986 (P-86572).

Additional updates to References 1 & 2 were provided in:

PSC letter, Lee to Johnson, dated August 30, 1985 (P-85301).
PSC letter, Lee to Hunter, dated September 26, 1985 (P-85341).

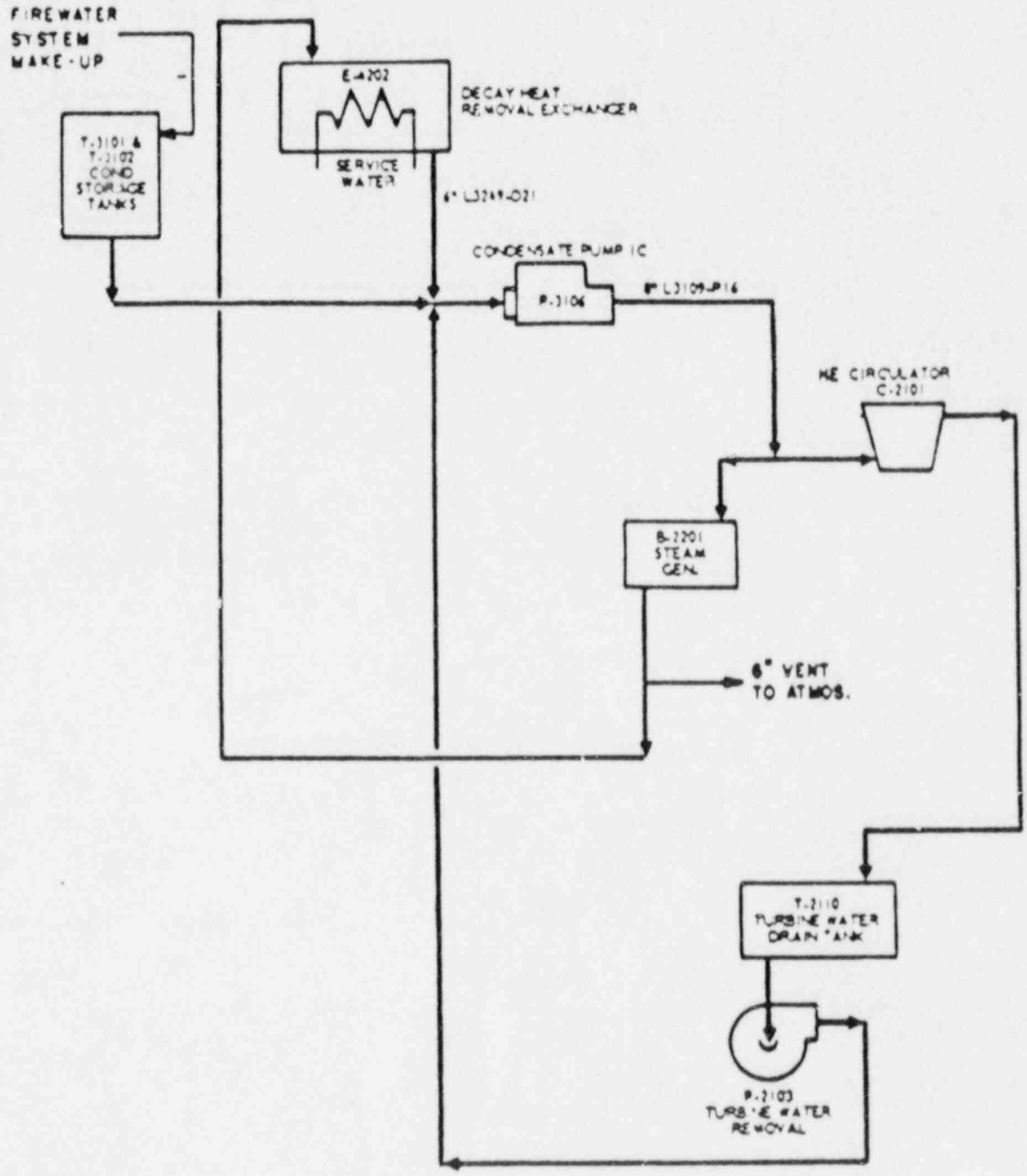

FIGURE 2.1-8

SIMPLIFIED FLOW DIAGRAM
CONDENSATE PUMP FOR CIRCULATOR DRIVE
& S/G COOLING - TRAIN A

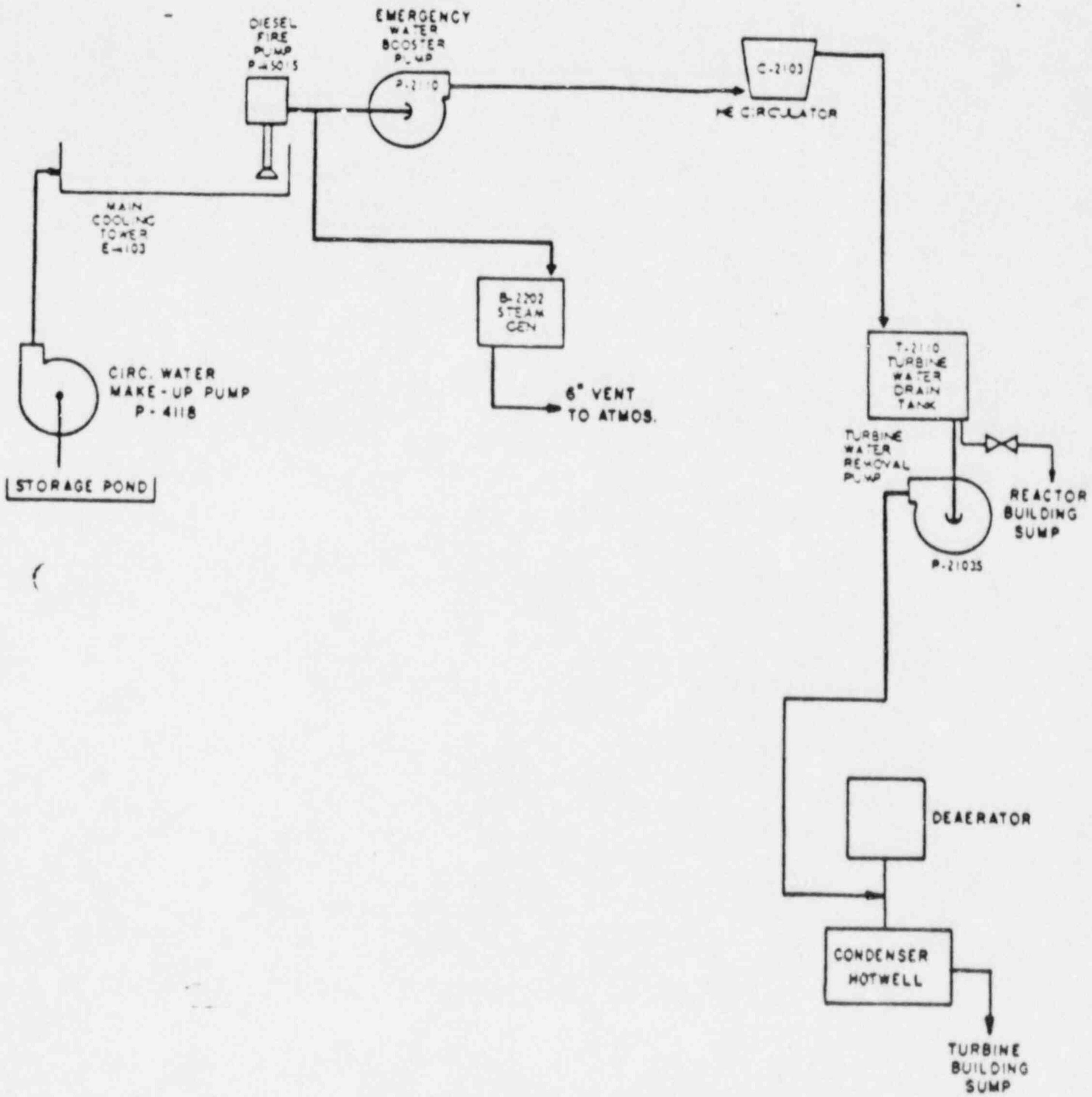

FIGURE 2.1-9

SIMPLIFIED FLOW DIAGRAM
FIRE WATER FOR CIRCULATOR DRIVE & S/G COOLING -
TRAIN B

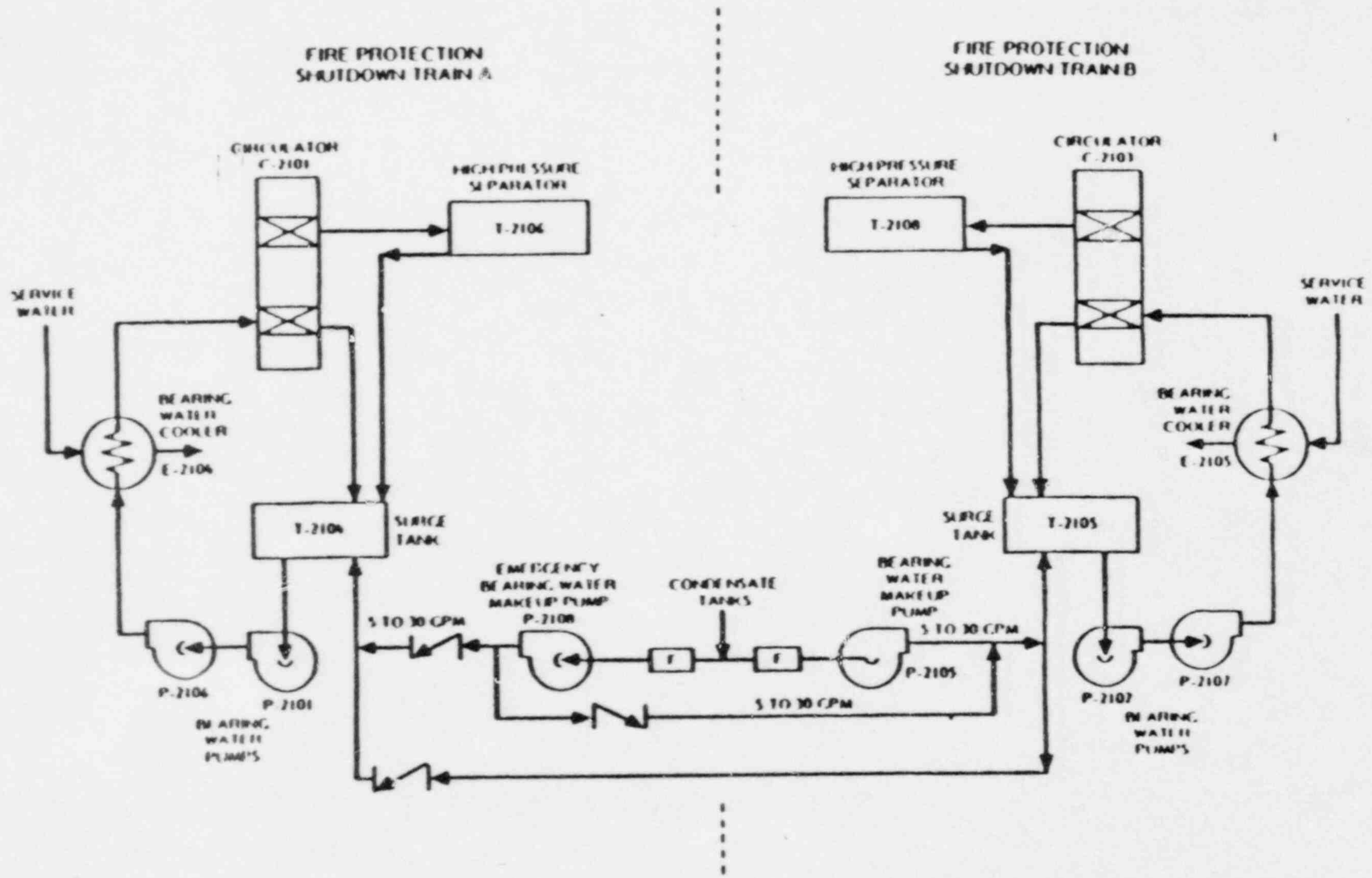

FIGURE 2.1-10

SIMPLIFIED FLOW DIAGRAM
BEARING WATER FOR CIRCULATORS

ATTACHMENT 3

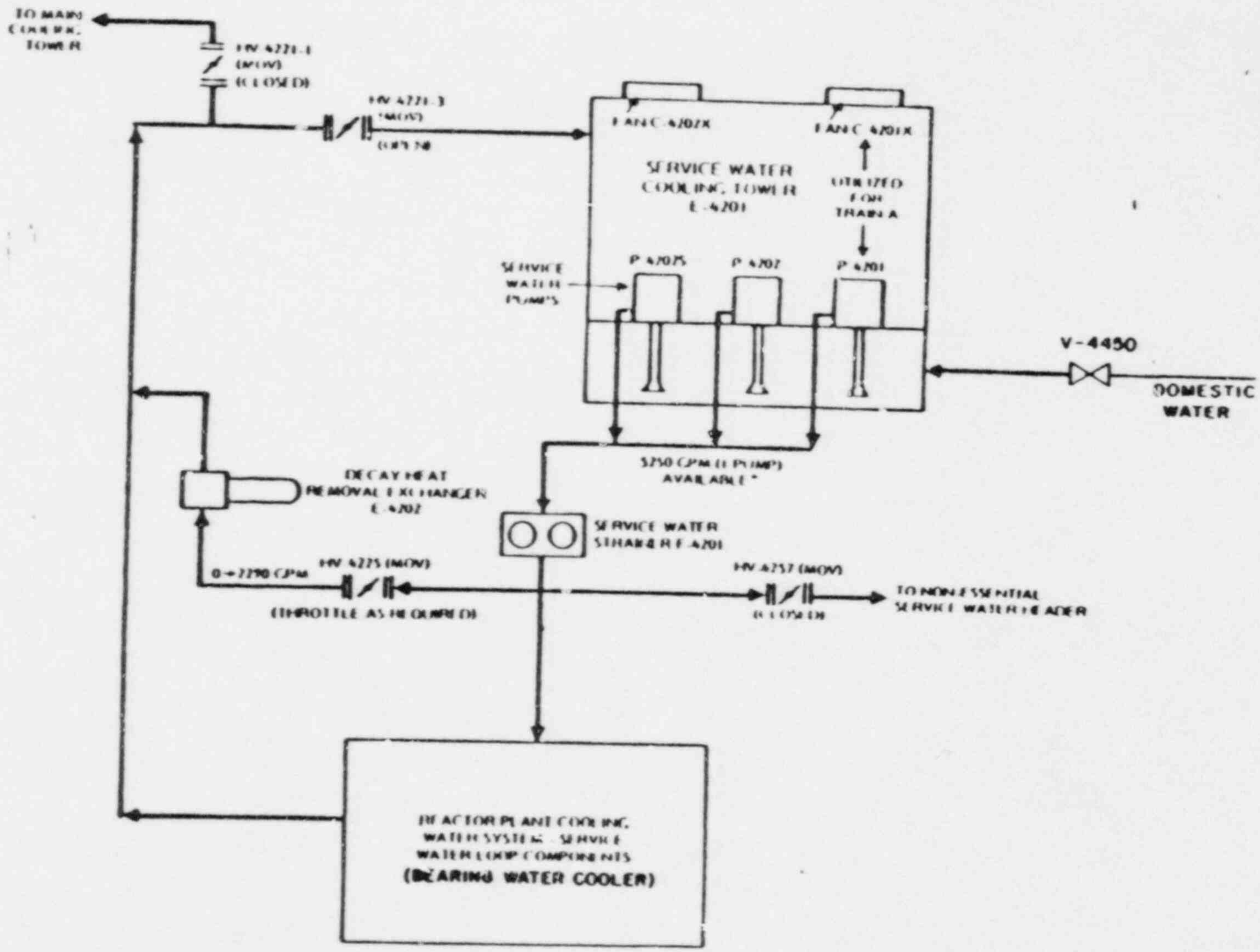

FIGURE 2.1-11A

SIMPLIFIED FLOW DIAGRAM - SERVICE WATER SYSTEM - TRAIN A

*NOTE: ONE PUMP DESIGNATED FOR TRAIN A, BUT TWO PUMPS AVAILABLE FOR ALL AREAS THAT RELY ON TRAIN A.

REV 7

ATTACHMENT 4

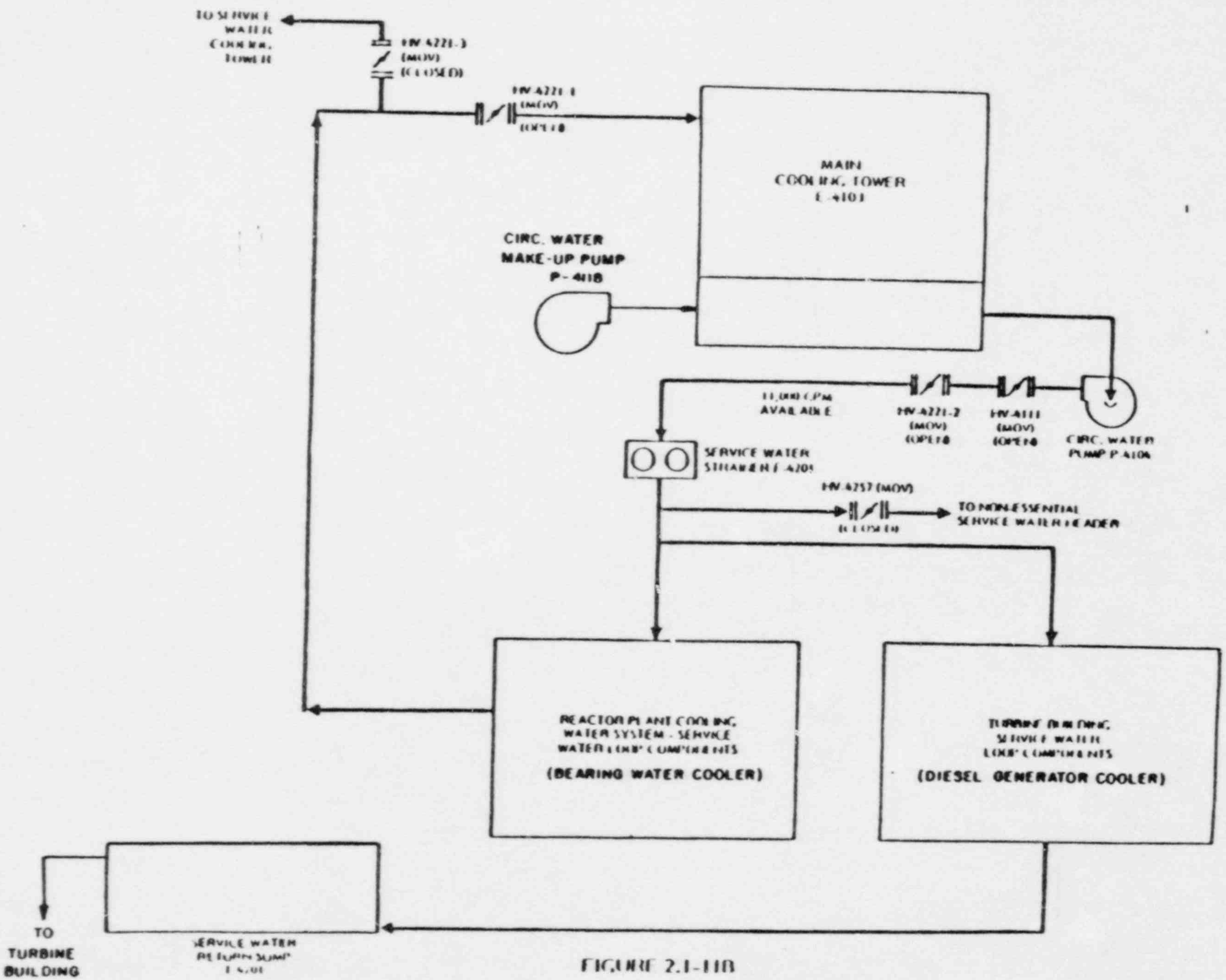

FIGURE 2.1-11B

SIMPLIFIED FLOW DIAGRAM - SERVICE WATER SYSTEM - TRAIN B

REV 7