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

MAY 1 9 1981

Docket Nos.: 50-445
and 50-446

Mr. R. J. Gary
Executive Vice President and
General Manager
Texas Utilities Generating Company
2001 Bryan Tower
Dallas, Texas 75201

Dear Mr. Gary:

Subject: Request for Additional Information for Comanche Peak Steam Electric Station, Units 1 and 2

The Auxiliary Systems Branch, Division of Systems Integration has reviewed the Final Safety Analysis Report (FSAR) for Comanche Peak Steam Electric Station Units 1 and 2. Based on our review of this information, we have prepared a draft input to the Safety Evaluation Report. In this draft to the Safety Evaluation Report we have identified areas for which sufficient information has not been submitted to determine how the design of certain auxiliary systems conform to the guidance provided in the Standard Review Plan, NUREG-75/087. We are enclosing a copy of the draft to the Safety Evaluation Report (Enclosure 1) to assist you in understanding our requirements for additional information. Please note that this draft is incomplete; i.e., Sections 3.6.1, 9.2.2, 10.4.9, and TMI: II.E.1.1 normally provided by the Auxiliary Systems Branch are not included.

In order to expedite resolution of these matters we have not taken the time to examine alternative solutions to the positions stated in this document. After your staff has had an opportunity to review these items, we will be available to discuss how the designs satisfy the functional objectives of the systems in question. The areas where sufficient information has not been provided will remain open items until such time that these matters may be resolved by discussions between us, or until Texas Utilities Generating Company provides the necessary information.

Please expedite your review of this request for additional information in order that we may resolve these open items prior to the issuance of the Safety Evaluation Report.

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A copy of the enclosure to this letter was given to Mr. Richard Werner of your staff on Wednesday, May 13, 1981, during his visit to our offices.

Should you have questions concerning this request for additional information or desire to meet with us on this matter, please contact us.

Sincerely,

B. J. Youngblood

B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

Enclosures:
Draft Input to the Safety
Evaluation Report

cc w/encl.: See next page

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Enclosure

Draft Input to the Safety Evaluation Report

for the

Comanche Peak Steam Electric Station, Units 1 & 2

Prepared by the Auxiliary Systems Branch

A Request for Additional Information

3.4 Water Level (Flood) Design

Our review included the applicant's design to protect safety-related systems, structures and components from flood damage and to maintain the capability for a safe facility shutdown during a design basis flood.

The calculated probable maximum flood level for the facility is elevation 789.7 feet. Although portions of the service water intake structure are below this elevation, the safety-related service water pump motors, valve operators and controls, are above the maximum flood. There is essential equipment in the safeguards building below the maximum flood level. ~~but~~ However, the grade elevation for the Safeguards Building is at grade elevation 810.0 feet; no doors or entries to the safeguards building are located below the maximum flood level. Water stops are used in all construction joints below grade and safety-grade sump pumps are provided for the safeguards building. The lowest elevations of the auxiliary building and fuel building are above the maximum flood level. The only area of concern with regard to exterior flooding involves the safety chilled water system pumps and condensers located on elevation 778 feet of the electrical and control building. This elevation of the electrical and control building has direct access to the turbine buildings. It is not clear that the safety chilled water system could not be disabled by high flood waters originating in the turbine building. One path for flood water into the turbine building could be through the circulating water system pipe tunnel which is open to the turbine building at elevation 758 feet 6 inches.

The protection afforded essential structures, systems and components from the effects of precipitation is acceptable. There is no roof drain piping inside safety related structures. Relief openings in roof parapets and downspouts are provided to limit water buildup on the roofs to eight inches for the probable maximum precipitation condition.

The protection afforded essential equipment from the effects of interior ~~following~~ flooding sources is discussed in sections 9.3.3 and 10.4.5 of this Safety Evaluation Report.

The licensee should provide verification that the safety chilled water pumps and chillers are adequately protected against the effects of the probable maximum flood.

As a result of our review, we conclude that the facility design, with the exception of the safety chilled water system, meets the requirements of Criterion 2 of the General Design Criteria with respect to protection of essential equipment from the effects of the probable maximum flood and probable maximum precipitation and is, therefore, acceptable. We will provide resolution of the flood protection for the safety chilled water system in a supplement to this Safety Evaluation Report.

3.5.1.1 Internally Generated Missiles (Outside Containment)

Protection against postulated internally generated missiles outside containment associated with plant operation, such as missiles generated by rotating or pressurized equipment is provided by any one or a combination of barriers, separation, restraint of potential missiles, strategic orientation, and equipment design. The primary means of providing protection to safety-related equipment is through the use of plant physical arrangement. The majority of safety-related systems are physically separated (within separate compartments) from nonsafety-related systems and the redundant components of safety-related systems are physically separated such that a potential missile could not damage both trains of the safety-related system. However, redundant trains of safety chilled water system pumps and chillers are located in the same compartment and it is not clear that adequate missile protection has been provided to these components ~~compartments~~. The safety chilled water system is required for plant shutdown in the event of a loss of offsite power or design basis accident.

As recommended by Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis," the spent fuel is protected from internally generated missiles by the fuel pool walls and by designing the fuel handling system such that a seismic event will not result in missile generation. The fuel handling system is discussed further in section 9.1.4 of this Safety Evaluation Report.

The applicant should provide verification that adequate missile protection has been afforded the safety chilled water system where components in redundant trains are located in the same compartment. The applicant should verify that at least one train will be available to support shutdown of its associated reactor unit in the event of any internally generated missile outside containment.

We have reviewed the adequacy of the applicant's design necessary to maintain the capability for a safe shutdown in the event of any internally generated missile outside containment. We have concluded that, except for the safety chilled water system, the design is in conformance with Criterion 4 of the General Design Criteria as it relates to structures housing essential systems and to the capability of the systems to withstand the effects of internally generated missiles, and Regulatory Guide 1.13 as it relates to protection from internal missiles, and is, therefore, acceptable. We will report on the adequacy of the protection afforded the safety chilled water system from internally generated missiles outside containment in a supplement to this Safety Evaluation Report.

3.5.2 Structures, Systems, and Components to be Protected from Externally Generated Missiles

General Design Criterion 4 requires that all components essential to the safety of the plant be protected from the effects of externally generated missiles. The applicant has stated that all seismic Category I structures are designed to withstand postulated tornado missiles without damage to safety-related equipment.

To show conformance with General Design Criterion 4, the applicant has identified all safety-related structures, systems and components that need to be protected from externally generated missiles. With the exception of certain piping located outside the seismic Category I structures, essential systems and components are adequately protected from all postulated externally generated missiles. The licensee will verify that essential piping from the outdoor reactor water storage tank, condensate storage tank and reactor makeup water storage tank are protected throughout their length by seismic Category I pipe tunnels which will prevent damage by externally-generated missiles. The evaluation of the adequacy of barriers or structures designed to withstand the effects of missiles can be found in section 3.5.3 of this Safety Evaluation Report.

We have reviewed the applicant's list of safety-related structures, systems and components to be protected from externally generated missiles and the adequacy of protection provided for these structures, systems and components.

We conclude that the applicant has identified all safety-related structures, systems and components that need protection from externally generated missiles and has provided adequate protection in accordance with General Design Criterion 4 except for certain essential piping located outside. We, therefore, conclude that, except for the outside piping, ~~that~~ they are acceptable. We will report on the adequacy of the protection afforded the essential piping runs from the safety-related tanks to seismic Category I buildings in a supplement to this Safety Evaluation Report.

AUXILIARY SYSTEMS BRANCH
COMANCHE PEAK 1&2
SAFETY EVALUATION REPORT

9.0 Auxiliary Systems

We reviewed the design of the auxiliary systems, including their safety-related objectives, and the manner in which these objectives are achieved.

We reviewed the auxiliary systems which are necessary for safe facility shutdown. These include the station service water system, component cooling water system, ultimate heat sink, condensate storage facilities, portions of the chemical and volume control system, safety-related ventilation systems, and safety chilled water system.

We reviewed the systems necessary to assure safe handling of fuel and adequate cooling of spent fuel which include the new and spent fuel storage facilities, portions of the spent fuel pool cooling and cleanup system, portions of the fuel handling system, and the fuel building ventilation system.

We reviewed the equipment and floor drainage system and ventilation systems, whose failure would not prevent safe shutdown, but indirectly could be a potential source of radiological release to the environment.

We also reviewed certain auxiliary systems whose failure would neither prevent safe shutdown nor result in potential radioactive releases but could affect safety-related systems. These include the pressurizer relief discharge system, demineralized and reactor makeup water system, potable and sanitary water system, surface water pre-treatment system, plant chilled water system and the non-safety-related ventilation systems. The acceptability of these systems was based on our determining that: (a) where the system interfaces or connects to a seismic Category I system or components, seismic Category I isolation valves will be provided to physically separate the non-essential portions from the essential system or components, and (b) the failure of non-seismic systems or portions of the systems will not preclude the operation of safety-related systems or components located in close proximity. We find the above listed systems meet our criteria and, therefore, find them acceptable.

9.1 Fuel Storage and Handling

9.1.1 New Fuel Storage

The new fuel storage pit, shared by both reactor units, provides dry storage capability for 132 fuel assemblies, two-thirds of the fuel assemblies in a full core load. The fuel assemblies are stored in racks which are bolted to the floor of the pit. The design of the rack precludes the insertion of fuel assemblies in other than prescribed locations. The spacing maintained between fuel assemblies will limit the effective multiplication factor to 0.98 with fuel of the highest anticipated enrichment, assuming optimum moderation (under dry or flooded conditions). The racks are designed to seismic Category I requirements and will withstand an uplift force equal to the maximum force which can be exerted by the fuel handling bridge crane. The fuel racks are also designed to withstand the impact of a fuel assembly dropped from the maximum lift height of the fuel handling bridge crane without causing an unsafe geometric spacing of the new fuel assemblies. The new fuel storage pit is located within the fuel building which is a controlled air-leakage building designed to seismic Category I requirements. The fuel building structure protects the new fuel storage facility from the effects of tornadoes and tornado-generated missiles.

We have reviewed the adequacy of the applicant's design for the new fuel storage facility necessary to maintain a subcritical array during normal, abnormal and accident conditions. In general, the design provisions of the facility are sufficient to the above-stated objective. However, the applicant has not verified that the analysis used to determine the maximum effective multiplication factor of 0.98 considered the moderating effects of water fogging and spray.

~~In addition, the licensee has not verified that the new fuel storage pit has provisions for water drainage.~~ We have concluded that, pending verification of the considerations noted above, the design of the facility is in conformance with Criteria 5 and 62 of the General Design Criteria and the positions of Regulatory Guide 1.13, "Fuel Storage Facility Design Basis," and is, therefore, acceptable.

9.1 Fuel Storage and Handling

9.1.1 New Fuel Storage

The new fuel storage pit, shared by both reactor units, provides dry storage capability for 132 fuel assemblies, two-thirds of the fuel assemblies in a full core load. The fuel assemblies are stored in racks which are bolted to the floor of the pit. The design of the rack precludes the insertion of fuel assemblies in other than prescribed locations. The spacing maintained between fuel assemblies will limit the effective multiplication factor to 0.98 with fuel of the highest anticipated enrichment, assuming optimum moderation (under dry or flooded conditions). The racks are designed to seismic Category I requirements and will withstand an uplift force equal to the maximum force which can be exerted by the fuel handling bridge crane. The fuel racks are also designed to withstand the impact of a fuel assembly dropped from the maximum lift height of the fuel handling bridge crane without causing an unsafe geometric spacing of the new fuel assemblies. The new fuel storage pit is located within the fuel building which is a controlled air-leakage building designed to seismic Category I requirements. The fuel building structure protects the new fuel storage facility from the effects of tornadoes and tornado-generated missiles. INSERT "A"

We have reviewed the adequacy of the applicant's design for the new fuel storage facility necessary to maintain a subcritical array during normal, abnormal and accident conditions. ~~In general,~~ The design provisions of the facility are sufficient to the above-stated objective. However, the applicant has not verified that the analysis used to determine the maximum effective multiplication factor of 0.98 considered the moderating effects of water fogging and spray.

In addition, the licensee has not verified that the new fuel storage pit has provisions for water drainage. We have concluded that, pending verification of the considerations noted above, the design of the facility is in conformance with Criteria 5 and 62 of the General Design Criteria and the positions of Regulatory Guide 1.13, "Fuel Storage Facility Design Basis," and is, therefore, acceptable.

9.1 Fuel Storage and Handling

9.1.1 New Fuel Storage

The new fuel storage facility includes the new fuel assembly storage racks and the concrete storage pit that contains the storage racks. The new fuel storage pit, shared by both reactor units, provides dry storage capability for 132 fuel assemblies, two-thirds of the fuel assemblies in a full core load. Thus, there is storage capacity for one-third of a core for each reactor and the requirements of General Design Criterion 5 "Sharing of Structures, Systems and Components" are satisfied.

The new fuel storage pit is housed within the fuel building which is a seismic Category I structure. The new fuel storage racks are also designed to seismic Category I requirements. The fuel building protects the new fuel storage facility from the effects of tornadoes, tornado-generated missiles and flooding (refer to Sections 3.4.1 and 3.5.2 of this SER). Thus, the requirements of General Design Criterion 2 "Design Bases for Protection Against Natural Phenomena" and the guidance of Regulatory Guide 1.29 "Seismic Design Classification" are satisfied. The compliance of the design relative to the requirements of General Design Criterion 4 "Environmental and Missile Design Bases" is discussed in Section 3.6.1 of this SER.

The facility is designed to store unirradiated, low emission, fuel assemblies. Accidental damage to the fuel would release relatively minor amounts of radioactivity that would be accommodated by the fuel building ventilation system (refer to Section 9.4.2 of this SER). Thus, the requirements of General Design Criterion 61 "Fuel Storage and Handling and Radioactivity Control" are satisfied.

We have reviewed the adequacy of the applicant's design for the new fuel storage facility necessary to maintain a subcritical array during normal, abnormal and accident conditions. The fuel assemblies are stored in racks bolted to the floor of the pit such that a center-to-center spacing of 21 inches is maintained between assemblies. This spacing will limit the effective multiplication factor to 0.98 with the fuel of the highest anticipated enrichment, assuming optimum moderation (under dry or flooded conditions). However, the applicant has not verified that the moderating effects of foam and water fogging and spray were considered in the analysis used to determine the maximum effective multiplication factor of 0.98. The design of the racks precludes the insertion of fuel assemblies in other than the prescribed locations. The racks are designed to withstand an uplift force equal to the maximum force which can be exerted by the fuel handling bridge crane. The fuel racks are also designed to withstand the impact of a fuel assembly dropped from the maximum lift height of the fuel handling bridge crane without causing an unsafe geometric spacing of the new fuel assemblies. Thus, except for the uncertainty in the calculation for maximum effective multiplication factor, the requirements of General Design Criterion 62 "Prevention of Criticality in Fuel Storage and Handling" are satisfied.

Radiation monitoring equipment for the new fuel storage area is provided and is evaluated in Section 12 of this SER thus satisfying the requirements of General Design Criterion 62 "Monitoring Fuel and Waste Storage."

In order to satisfy the requirements of General Design Criterion 62, the applicant should verify that the calculation for the maximum effective multiplication factor of 0.98 included the moderating effects of foam and water fogging and spray or verify that the design of the new fuel storage facility will preclude these effects.

Based on our review, we conclude that the new fuel storage facility is in conformance with the requirements of General Design Criteria 2, 5, 61 and 63 as they relate to new fuel protection against natural phenomena, sharing of essential systems, radiation protection and radiation monitoring, and the guidelines of Regulatory Guide 1.29 relating to seismic design. The adequacy of the design relative to protection against missiles and pipe breaks as required by General Design Criterion 4 is discussed in Section 3.6.1. Upon receipt of verification regarding the effective multiplication factor, we will report on the adequacy of the design relative to the requirements of General Design Criterion 62 for prevention of criticality in a supplement to this SER.

9.1.2 Spent Fuel Storage

Spent fuel will be stored underwater in the two spent fuel pools in the fuel building. The fuel assemblies will be placed in racks which are bolted into the floor of the pools. The spent fuel storage racks and damaged fuel containers will provide a total on-site storage capacity ~~of~~ for 1166 fuel assemblies: 1116 assemblies in the pools and 25 assemblies in each containment cavity. This capacity exceeds the required capacity of 1-2/3 cores (322 assemblies). The racks maintain a spacing between fuel assemblies sufficient to limit the maximum effective multiplication factor to 0.95, even if unborated water is used to fill the spent fuel storage pool. Space between storage positions is blocked to prevent storage of a fuel assembly in other than prescribed locations. The storage racks can withstand the impact of a dropped spent fuel assembly from the maximum lift height of the fuel handling bridge crane without unacceptable damage to the fuel or change in the geometric spacing between assemblies. The storage racks can also withstand an uplift force equal to the uplift force of the spent fuel pool bridge hoist. The spent fuel racks and the fuel building structure are designed to seismic Category I requirements. The fuel building structure protects the ~~new~~ spent fuel storage facility from the effects of tornadoes and tornado-generated missiles.

We have reviewed the adequacy of the applicant's design for the spent fuel storage facility necessary to maintain a subcritical array during all operating conditions. Our evaluation of the fuel cask handling is provided in Section 9.1.4 of this Safety Evaluation Report. We conclude that the design for the spent fuel storage facilities is in conformance with the requirements of Criteria 5, 61 and 62 of the General Design Criteria and the positions of

Regulatory Guides 1.13 and 1.29, including the positions on seismic design and missile protection, and, therefore, is acceptable.

9.1.3 Spent Fuel Pool Cooling and Cleanup System

The spent fuel pool cooling and cleanup (purification) system is designed to maintain the clarity and purity of the water in the spent fuel pools, the transfer canal, the refueling water storage tank (RWST) and the refueling cavities, and to remove heat generated by ~~stored~~ spent fuel elements stored in the fuel pools.

The fuel pool cooling system is designed to Quality Group C and seismic Category I requirements. It consists of two redundant cooling loops, each capable of simultaneously servicing both of the spent fuel pools. Each cooling loop includes a pump, heat exchanger and associated piping, valving and instrumentation. The fuel pool cooling pumps are powered from the Class 1E electrical system. The fuel pool heat exchangers can be cooled by the Quality Group C, seismic Category I portion of the component cooling water system associated with either reactor unit. There are no drain lines that could lead to inadvertent draining of the spent fuel pools. Spent fuel pool cooling suction lines are located four feet below the normal pool water level. Although the cooling system return lines terminate about 20 feet below normal water level, antisiphon holes in the lines prevent siphoning more than 12 inches below the normal water level. Thus, except for a failure of the gates between the spent fuel pools and the fuel transfer canal, the design of the spent fuel pool fluid systems ensure that at least 10 feet of water will cover the top of the active fuel. Failure of the gates between the fuel pools and transfer canal would drop the spent fuel pool water level to within three feet of the top of the active fuel. The gates are not listed as seismically designed equipment and could be presumed to fail in an earthquake.

With both spent fuel pool cooling trains operating, the pool water temperature can be maintained at 137 degrees Fahrenheit with the maximum design heat load. The maximum design heat load results from the decay heat from one full core at 150 hours after shutdown, one-third of a core at 150 hours after shutdown, one-third of a core at 480 hours after shutdown and the remainder of both spent fuel pools filled with fuel assemblies from twelve normal refuelings involving one-third of a core each. The resulting maximum heat load temperature is below the maximum acceptable temperature of 140 degrees Fahrenheit. The spent fuel pool water temperature can also be kept at or below 135 degrees Fahrenheit with one loop out of service and a normal design heat load, that is, the decay heat resulting from the same number of fuel assemblies listed above except for the full-core emergency unload. The spent fuel pool temperature can be maintained at or below an acceptable temperature of 169 degrees Fahrenheit for the maximum design heat load with one spent fuel pool cooling train out of service.

The normal makeup water supply to the spent fuel pools is from the nonnuclear-safety grade demineralized water system. A redundant makeup water source is provided by the seismic Category I reactor makeup water system. Water can also be supplied to the spent fuel pools from the refueling water storage tanks through various piping paths.

The spent fuel pool cooling system is located within the seismic Category I fuel building. The fuel building structure protects the spent fuel pool cooling system from the effects of tornadoes and tornado missiles. The redundant spent fuel pool cooling pumps are located in separate compartments away from the path of travel of the fuel building crane.

The spent fuel pool purification system is a nonseismic Category I system connected to, but manually isolable from the spent fuel pool cooling system by Quality Group C, seismic Category I valves. Manual isolation is acceptable because of the redundancy provided by the spent fuel pool cooling system and spent fuel pool makeup system. Two spent fuel pool purification loops are provided to remove fission products and other contaminants from the pool water by filtration and ion exchange. Operation of either loop provides sufficient purification capability for both spent fuel pools to permit unrestricted access to the spent fuel storage area. The failure of either or both purification loops does not have an adverse affect on any safety-related system.

To provide assurance that at least 10 feet of water will cover the active fuel stored in the spent fuel pools under all conditions, the applicant should verify that the gates between the spent fuel pools and the fuel transfer canal will remain watertight during a safe shutdown earthquake.

Based on our review, we conclude that, except for the spent fuel pool gates, the design of the spent fuel pool cooling and cleanup system is in conformance with Branch Technical Position ASB 9-2 with respect to decay heat loads, the guidelines of Regulatory Guides 1.13 and 1.29 including the positions on availability of assured makeup sources, the seismic design and missile protection, and the requirements of Criteria 5, 61 and 62 of the General Design Criteria. Pending satisfactory resolution of the seismic design of the spent fuel pool gates we, therefore, find the fuel pool cooling and cleanup system acceptable.

9.1.4 Fuel Handling System

The fuel handling system, in conjunction with the fuel storage area, provides a means of transporting, handling and storing of fuel. The fuel handling system consists of equipment necessary for the safe handling of the spent fuel cask and for safe disassembly, handling, and reassembly of the reactor vessel head and internals during refueling operations. The system also includes additional equipment designed to facilitate the periodic refueling of the reactor.

The major components of the fuel handling system are the refueling machine, fuel transfer system, fuel handling bridge crane, containment polar crane and fuel building crane. The refueling machine, a bridge crane spanning the refueling cavity, is designed for the safe handling of fuel assemblies inside containment. The refueling machine main hoist is provided with two independent braking systems: an electrical brake on the motor shaft and a mechanically-actuated brake internal to the hoist gearbox. Fuel assemblies are conveyed between the containment and fuel building by the fuel transfer system. The fuel transfer car runs on rails between the containment fuel storage area and the fuel transfer canal in the fuel building via the fuel transfer tube. The fuel handling bridge crane is used to transfer single fuel assemblies within the spent fuel pools, refueling canal and cask pit. Lift-limiting devices on the refueling machine and fuel handling bridge crane, along with handling tool configuration, assure that spent fuel assemblies are not lifted above the safe shielding depth provided by the water in the refueling cavity, refueling canal and spent fuel pools. Redundant interlocks are provided for the refueling machine, fuel transfer system and fuel handling bridge crane to prevent simultaneous motion of fuel assemblies in more than one direction or motion of the fuel assemblies when an unsafe equipment configuration exists. The containment polar crane, fuel building crane, refueling machine and fuel handling bridge crane are designed, tested and maintained in accordance with applicable sections of Specification 70 of the Crane Manufacturers Association of America, Inc. The spent fuel handling tool and fuel transfer system components are designed to seismic Category I requirements. The refueling machine, containment polar crane, fuel handling bridge crane and fuel building crane are designed to stay in place during the safe shutdown earthquake. Additional discussion of the polar crane and fuel building crane is provided below.

The fuel ~~handling bridge~~ building crane has three hoisting systems on the trolley rated for 130 tons, 17 tons and 5 tons. The heaviest load to be handled by this crane is the spent fuel shipping cask. The range of travel of this crane includes the spent fuel cask loading area, new fuel storage pit, cask handling area, new fuel receiving area and the railroad loading and unloading area. Its range of travel does not include the spent fuel pools or the fuel building area housing the spent fuel pool cooling pumps and heat exchangers. The crane is prevented by interlocks from moving over the new fuel pit during cask handling operations. The closest areas of travel during cask handling operations are more than 15 feet from the spent fuel pools and are separated by concrete walls from the pools. The concrete floors can withstand a fully loaded cask drop from the maximum lifting height of 29.25 feet.

The containment polar crane is rated for 175 tons for refueling or maintenance operations. The heaviest load expected to be lifted is the reactor vessel head assembly. Various accident cases (i.e. dropping a reactor vessel head assembly in the refueling cavity) were analyzed to determine the consequences. These analyses have been provided in WCAP-9198, dated January 1978. The staff has not completed its review of this report.

Based on our review, we conclude that the fuel handling system can adequately perform its intended function. Further, based on the design of the fuel building crane, we conclude that handling of spent fuel and the consequences of a cask drop will not impair safe shutdown capability nor result in unacceptable damage to the spent fuel storage facility and is, therefore, acceptable. We will report on the adequacy of the containment polar crane design in a supplement to this Safety Evaluation Report after our review of WCAP-9198. We will require the applicant to upgrade the capabilities of this crane as necessary after our review of the reactor vessel head drop analyses.

9.2.1 Station Service Water System

The station service water system supplies cooling water to the plant from the safe shutdown impoundment, which is the ultimate heat sink discussed in Section 9.2.5 of this Safety Evaluation Report. The station service water system cools the component cooling water heat exchangers, emergency diesel generators, lube oil coolers for the safety injection and centrifugal charging pumps and bearing coolers for the containment spray pumps. All of the above cooling loads are required for plant shutdown and/or for mitigating the effects of a loss-of-coolant accident; no other cooling loads are serviced by this system. The station service water system can also be used as a backup water supply for the auxiliary feedwater system and the fire protection booster pumps.

The station service water system consists of two separate and independent full capacity trains for each reactor unit; cross-connected (ions) are provided between trains for flexibility. Each train has one full-capacity pump which can be supplied from a separate emergency diesel bus. One train is in operation at all times during normal operation to supply cooling for one train of the essential heat loads listed above. If the operating station service water pump trips, the other pump automatically starts and is operative within 60 seconds to cool the redundant train of essential equipment. During normal
recirculation phase both trains are normally used although only one train need be operative. During the post-LOCA
unit cooldown and the post-LOCA injection phase, only one station service water system train is used.

The station service water system is designed to Quality Group C and seismic Category I requirements. Connections to other nonessential systems are isolated by Quality Group C, seismic Category I valves that are normally shut. The valves to the fire protection system are locked closed. Components of the system are located in seismic Category I structures which provide protection against tornadoes and tornado-generated missiles. Station service water system piping between the pumphouse and the auxiliary building and between the auxiliary building and the safe shutdown impoundment is buried to protect the piping from tornado missiles. Pump motors, valve operators and controls in the pumphouse are located above the postulated level of the probable maximum flood.

The station service water system operates during normal operation; therefore it does not require additional periodic tests and inspection of the system safety functions. However, the components in operation are interchanged periodically to enable testing and inspection. Recirculation loops are provided around the pumps for testing of these components. Valves, controls and instrumention are also tested periodically. The performance of the heat exchangers in monitored periodically to detect excessive scale formation.

Check Tech Specs

Based on our review, we conclude that the station service water system is in conformance with the requirements of Criterion 44 of the General Design Criteria regarding the ability to transfer heat from safety-related components to the ultimate heat sink and regarding the single-failure criterion. It is also in conformance with requirements of Criteria 45 and 46 of the General Design Criteria regarding the system design for periodic test and inspections, including functional testing and confirmation of heat transfer capabilities. We, therefore, conclude that the system is acceptable.

9.2.3 Ultimate Heat Sink

The ultimate heat sink provides cooling water to the service water systems of both reactor units for normal cooldown and for post-accident shutdown and serves as a backup water source for the auxiliary feedwater systems via the service water systems. The ultimate heat sink (safe shutdown impoundment) is an enclosed body of water formed from a cove of the Squow Creek Reservoir and retained by a seismic Category I dam. The service water pumps take suction from the safe shutdown impoundment at the service water intake structure. After serving its plant cooling function, warmer service water is returned to the impoundment. The service water intake structure and service water discharge outfall are separated by over 1800 feet to promote thermal mixing. The service water system is discussed further in section 9.2.1 of this Safety Evaluation Report.

The safe shutdown impoundment and dam can withstand the effects of the safe shutdown earthquake, tornadoes, tornado-generated missiles and the flood conditions of the probable maximum flood. Makeup to the safe shutdown impoundment is provided by an equalization channel between the impoundment and the Squaw Creek Reservoir which maintains the impoundment water level at elevation 775 feet during normal operations. The impoundment water level would fall to the elevation of the bottom of the equalization chanel, i.e., 769 feet 6 inches, in the event of a failure of the nonsafety-related Squaw Creek Reservoir dam. The safe shutdown impoundment is sized to perform its design function after 40 years of sedimentation.

The applicant has shown by analysis that the ultimate heat sink has the capability to provide adequate water inventory and provide sufficient heat dissipation to keep service water system operating temperatures within acceptable limits. The analysis considered the heat rejected as a result of simultaneous shutdown and cooldown of both reactor units as well as post-design-basis-accident cooldown of one unit concurrent with shutdown and cooldown of the other unit. The ultimate heat sink is designed to accomodate the latter set of conditions which are more severe. The analysis considered no makeup of water to the impoundment for 39 days following a design basis accident in one unit. The most severe meteorological conditions for a thirty-year period were used in the analysis such that the maximum impoundment temperature calculated at eight days after the accident includes maximum heatup from plant cooling loads superimposed on the maximum temperature due to meteorological conditions. The decay heat rates used in the analysis are based on the ANS 5.1 fission product curve for a reactor operating time of 16,000 hours for both reactor units. A check of decay heat rates used for selected times in the transient indicate that the values used are consistent with the acceptable curves of total fission product decay heat and heavy element decay heat in Branch Technical Position ASB 9-2, "Residual Decay Energy for Light Water Reactors for Long Term Cooling".

Based on our review, we conclude that the design of the ultimate heat sink meets the positions of Branch Technical Position 9-2, the requirements of Criterion 5 of the General Design Criteria and the guidelines of Regulatory Guide 1.27 and, therefore, is acceptable.

9.2.4 Condensate Storage Facility

The condensate storage facility consists of one 500,000-gallon storage tank per reactor unit located outdoors next to the diesel generator building for its respective reactor unit. The condensate storage tanks are reinforced concrete, stainless steel-lined tanks designed to seismic Category I and Quality Group C requirements. The tanks are also designed to withstand tornadoes and missile impact. Each tank provides a reserve capacity of 276,000 gallons which constitutes the primary supply to the auxiliary feedwater system.

The auxiliary feedwater system reserve supply is maintained by locating ~~having~~ all non-safety-grade connections to the tank above the 276,000 - gallon level. All connections below this level are Quality Group C and seismic Category I including the auxiliary feedwater supply line. Inadvertent drainage of the tank is prevented by locked-closed double drain valves. In addition, automatically-operated valves isolate all other uses of the consensate storage tank when auxiliary feedwater operation is required.

Redundant level indicators are provided in the control room for the condensate storage tanks. Indication is also provided locally at the tanks. Level alarms are provided at high-high, low and low-low tank levels. Makeup can be provided to the condensate storage tank from the demineralized and reactor makeup water storage system.

Based on our review, we conclude that the consensate storage facility is designed to meet its intended safety function and is, therefore, acceptable.

9.3 Process Auxiliaries

9.3.1 Compressed Air System

The compressed air system consists of the instrument air system and the service air system. The instrument air system is supplied by one nonlubricated, single-stage, water-cooled reciprocating air compressor for each reactor unit. A third identical 100-percent capacity compressor is available on standby to provide instrument air for either reactor unit. The compressors associated with a reactor unit are cooled by the non-essential component cooling water loop of that unit. The standby compressor is cooled by the nonsafety-grade turbine plant cooling water system. The instrument air system also includes three aftercoolers and one accumulator, air dryer and filter set per unit. The service air system, shared by both reactor units, is supplied by two air ~~coolers~~ compressors. The service air system can serve as a backup to the instrument air system.

The instrument air syste, although serving air operated safety-related actuation devices and controls, is not required for the safe shutdown of the plant. Valves are designed to move to a fail-safe position on loss of air. In addition, the auxiliary feedwater flow control valves, steam supply valves to the turbine-driven auxiliary feedwater pump and the control room air dampers are provided with air accumulators. The air accumulators, the associated air piping between the first check valve and the pneumatic control valve, and the associated valves are Quality Group C and designed to seismic Category I requirements. All other system piping is nonsafety-grade except for the containment penetration piping and isolation valves which are Quality Group B and seismic Category I. To improve instrument air system availability, the compressor associated with a reactor unit can be manually loaded onto an emergency bus. However, the compressor is tripped from the emergency bus in the event of a safety injection signal.

Check documentation

The design of the compressed air system is in accordance with Regulatory Guides 1.26 and 1.29 with regard to Quality Group and seismic Category classification of the safety-related portions of the system and provides a continued supply of air to safety-related components as necessary during anticipated plant operating conditions. We, therefore, conclude that the system is acceptable.

9.3.3 Equipment and Floor Drainage System

The equipment and floor drainage system accomodates drains from potentially radioactive sources and from non-radioactive sources. The radioactive sumps and drains systems collect potentially radioactive liquid waste from equipment and floor drainage, including waste resulting from piping or tank ruptures, in the containment buildings, safeguards buildings, auxiliary building, fuel building and electrical and control building. These potentially radioactive wastes are, except as noted below, discharged to the floor drain tanks, waste holdup tanks or laundry and hot shower tanks of the liquid waste processing system. The liquid waste processing system is discussed in Section 11 of this Safety Evaluation Report. Drains from non-radioactive sources, such as the turbine building and diesel generator rooms, are normally aligned for discharge to the evaporation ponds. However, the turbine building sump is provided with a radiation monitor which would indicate and alarm a leak of radioactive material into this sump in the event of equipment failure or accident conditions. Discharge from the turbine building sump to the evaporation ponds can be manually terminated from the control room if turbine building sump discharge radioactivity becomes excessive.

There are two areas of concern with regard to the control of potentially radioactive liquid. Drainage from the letdown, letdown chiller, seal water containment spray and residual heat removal (RHR) heat exchangers and from the containment spray and RHR pumps can be diverted directly, or from the component cooling water drain tank room sump number 3, into the discharge piping from the component cooling water system to the evaporation pond. It has not been verified that there are provisions to prevent a discharge of radioactivity to the evaporation pond via this flow path. In addition, drainage collected in the auxiliary building floor drain sumps number 11 can be pumped directly to the evaporation pond via the turbine building drainage discharge path. It has not been verified that radioactive contamination in floor drain sumps number 11 would be detected before discharge into the evaporation pond.

In general, the floor drainage systems serving essential equipment is segregated into independent header and sump systems so that flooding of one train of essential equipment will not backflow into the compartments containing the redundant train. Backflow valves are also provided for floor drains. The compartments housing safeguards pumps in the safeguards building are designed to contain a leakage rate of 50 gpm for 30 minutes without causing flooding of adjacent areas, assuming all floor drains from this area are clogged. Redundant full-capacity sump pumps are provided to transfer drainage from building sumps to the drainage tanks. Sump pumps start automatically on high sump level. Instrumentation and alarms are provided for high sump level and sump pump operational status in the safeguards building, auxiliary building and diesel generator area floor drain systems. The safeguards building sump pumps and their discharge piping are designed to Quality Group C and seismic Category I requirements. Containment building drain system piping and isolation valves at the containment penetrations are designed to Quality Group B and seismic Category I requirements. The remainder of the system piping and backflow valves are not designed to seismic Category I criteria. This presents a concern in those areas where floor drains for redundant essential equipment rooms are connected to the same drain header. This is the case for the floor drains for all three auxiliary feedwater pump rooms and for redundant centrifugal charging pump rooms. (This condition may also exist for redundant component cooling water pump rooms; system drawings do not show floor drains for all of these rooms).

It has not been verified that failure of a non-seismic drain piping system due to a safe shutdown earthquake will not cause flooding of redundant essential equipment rooms where such rooms share the same drain header. Likewise, the drain piping design basis, i.e. a 50 gpm leak for 30 minutes, has not been justified.

The applicant should provide the following information to demonstrate the adequacy of the equipment and floor drainage system:

1. Verification that the discharge of drainage from the areas served by component cooling water drain tank room sump number 3 and auxiliary building floor drain sumps number 11 will not result in the discharge of excessive radioactive contamination to the evaporation pond.

2. Verification that a pipe break in any compartment plus a failure of the non-seismic drain system will not cause flooding of compartments containing redundant trains of essential equipment.

3. Justification for use of the floor drain piping design basis of a 50 gpm leak for 30 minutes or verification that a larger leak will not cause flooding of redundant essential equipment.

¶ Based on our review and pending satisfactory resolution of three items listed above, we conclude that the equipment and floor drainage system is adequate to protect safety-related areas and components from flooding and to prevent the inadvertent release of radioactive liquids to the environment and is, therefore, acceptable.

9.3.4 Chemical and Volume Control System

The chemical and volume control system is designed to control and maintain reactor coolant inventory and to control the boron concentration in the reactor coolant through the process of makeup and letdown. The system purifies the primary coolant by demineralization.

An essential portion of the system consists of two centrifugal charging pumps per reactor unit. These pumps are used for high pressure safety injection when the emergency core cooling system is required to function. This function is evaluated in Section 6 of this Safety Evaluation Report. The positive displacement charging pump provided for each reactor unit provides charging flow during normal operations although either one of the centrifugal charging pumps can also be used.

Boric acid at approximately four percent by weight is used for chemical reactivity control. The reactor makeup control system supplies a preset mixture of reactor makeup water and boric acid solution to the volume control tank or directly to the charging pump suction header to maintain the reactor coolant boron concentration and volume control tank inventory. Boric acid solution and reactor makeup water can be blended in varying proportions or used separately to change the reactor coolant boron concentration.

A separate chemical and volume control system is provided for each reactor unit. The boric acid batching tank and two boric acid tanks are shared by Units 1 and 2. The boric acid solution is made up in the batching tank and is transferred to the boric acid tanks as needed. Sufficient boric acid solution is stored in the boric acid tanks to accommodate a refueling in one unit and a cold shutdown in the other unit with the most reactive control rod not inserted. As a backup, borated water from the refueling water storage tank can be used for reactivity control. All portions of the chemical and volume control system that contain concentrated boric acid (four weight percent) are either located in heated rooms or are heat traced to maintain the solution temperature high enough to prevent precipitation of boron. Redundant temperature alarms are provided to assure room temperature does not go below 65 degrees Fahrenheit.

Control of the coolant inventory and maintenance of proper water chemistry is achieved by a continuous feed and bleed process during which the feed rate ~~will be~~ is automatically modulated by the pressurizer level. The letdown flow from the reactor coolant system is reduced in pressure, cooled in heat exchangers and processed through one of two mixed-bed demineralizers. If the inlet fluid temperature exceeds 140 degrees Fahrenheit, the flow bypasses the demineralizers to protect the resin bed. From the demineralizers, the flow is routed to the volume control tank where hydrogen is added to inhibit formation of oxygen in the coolant. Alternatively, flow from the demineralizers can be directed to the boron thermal regeneration system before being routed to the volume control tank. From the volume control tank, the letdown flow is charged back into the reactor coolant system by the charging pumps. If the coolant inventory needs to be reduced, part or all of the letdown flow can be routed to the boron recycle system.

Other chemicals that are added to the primary coolant via the chemical and volume control system are hydrazine to scavenge oxygen during startup, and lithium hydroxide for pH control.

The boron thermal regeneration subsystem is designed to control the changes in reactor coolant boron concentration to compensate for xenon transients during load following operations, without adding makeup for either boration or dilution. Storage and release of boron is controlled by the temperature of the fluid entering the thermal regeneration demineralizers.

The chemical and volume control system also supplies seal water injection flow for reactor coolant pump seal cooling and collects the controlled leakoff from the reactor coolant pump seals. In addition, it provides a means of filling, draining, and pressure testing of the reactor coolant system. The portions of the system required for safe shutdown of the reactor are designed to meet seismic Category I requirements, the single failure criteria and are powered from essential buses.

Based on our review of the chemical and volume control system and the requirements for system performance of necessary functions during normal, abnormal, and accident conditions, we conclude that the design of the chemical and volume control system and supporting systems is in conformance with the NRC's regulations as set forth in Criteria 2, 4, 5 and 33 of the General Design Criteria and meets the guidelines of Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," and Regulatory Guide 1.29, "Seismic Design Classification," and, therefore, is acceptable.

9.4 Heating, Ventilation and Air Conditioning

9.4.1 Control Room Area Ventilation System

The control room area ventilation system serves the combined Unit 1/Unit 2 control room as well as the adjacent supervisor's office, kitchen, and ancillary spaces. System components and duct work are designed to Quality Group C and seismic Category I requirements. The system is equipped with four 50-percent-capacity air conditioning units. Each pair of air conditioning units is powered from an independent Class 1E bus and is physically separated from the redundant pair by a fire wall. The system is also equipped with redundant full-capacity makeup air supply fans, exhaust fans, emergency pressurization air supply filtration units and fans, and emergency filtration units and fans. Redundant fans and filtration units are powered from independent Class 1E buses. These provisions assure adequate air handling capability in the event of a single failure of a system component. All of the air handling equipment is located within a seismic Category I structure which is designed to withstand tornado loads and tornado-generated missiles. The two air-intake louvers are designed to prevent passage of tornado missiles into the air handling equipment rooms.

The control room area ventilation system is designed to maintain the area within the environmental limits required for operation of plant controls and uninterrupted safe occupancy of required manned areas during all operational modes including the design basis accident conditions. The system is designed to maintain the control room under positive pressure.

Redundant radioactivity, chlorine and smoke detectors are provided in the air intakes to the control room area. In addition, area radioactivity and smoke detectors are provided in the control room and chlorine monitors are located in the vicinity of the circulating and service water chlorine containers. The operators can manually switch from the normal ventilation mode to the emergency recirculation mode upon receipt of alarms from any of the above detectors. The control room area ventilation system automatically switches to emergency recirculation upon failure of instrument air or offsite power, or upon receipt of a control room high radiation signal, a stack high radiation signal, a safety injection signal, a high-level-of-chlorine-gas-escape signal or a smoke detection signal. In the emergency recirculation mode all exhaust fans stop, exhaust dampers close, the outside air intake damper nearest the accident unit closes, and the air flow is recirculated through the emergency filtration units. If no chlorine gas is detected, the operators will replenish control room air by initiating emergency makeup to supply filtered outside air.

We have reviewed the design of the control room area ventilation system and conclude that it meets the requirements set forth in Criterion 19 of the General Design Criteria with regard to the capability to operate the plant from the control room during normal and accident conditions, that it meets the single failure criterion and, therefore, is acceptable.

9.4.2 Fuel Handling Building Ventilation System

The function of the fuel handling building ventilation system is to maintain a suitable environment for personnel and equipment during normal plant operations and scheduled shutdowns, and to limit potential radioactive release to the atmosphere during normal operation and postulated fuel handling accident conditions. A slight negative pressure is maintained in the fuel handling building to prevent the outflow of unfiltered, contaminated air to the environment. During normal operation, air is supplied to the fuel handling building by the supply units of the nonsafety-related primary plant ventilation system. Exhaust ducts in the spent fuel pool area and other fuel handling building spaces return the air to the exhaust filtration units of the primary plant ventilation system. Prior to refueling operations, the fuel handling building exhaust is directed to the two fifty-percent-capacity engineered safety features (ESF) exhaust filtration units. In the event of a fuel handling accident, air supply to the building is terminated by closing supply dampers; in this event one ESF exhaust filtration unit is adequate to maintain a negative pressure in the fuel building. Heat is dissipated from the spent fuel pool cooling pump rooms during loss of offsite power or following a fuel handling accident by using emergency fan coil units which are discussed further in section 9.4.4 of this Safety Evaluation Report.

The supply ducts and primary plant ventilation supply system components are all classified as nonnuclear-safety grade. The supply ducts are designed to remain in place and thus not pose a hazard to safety-related equipment in the event of a safe shutdown earthquake. The fuel handling exhaust ducts are designed to Quality Group C and seismic Category I criteria up to the exhaust fan discharges. The primary plant exhaust filtration units and ESF exhaust filtration units are designed to Quality Group C and seismic Category I requirements.

In general, a single failure in the fuel handling building ventilation system will not preclude performance of its safety function. However, if either the nonnuclear-safety grade supply damper fails open or the single exhaust damper fails shut, the system will not be able to maintain a negative pressure in the building.

Redundant radiation monitors are provided in the exhaust ducts downstream of the primary plant and ESF exhaust filtration units to alarm an excessive release of radioactivity. The location of these monitors downstream of the filtration units and exhaust dampers does not provide the capability to isolate the system before radioactivity is released to the environment.

The applicant should make the following modifications to the fuel handling building ventilation system:

1. Redundant exhaust flow paths should be provided through the wall separating the fuel building and the auxiliary building. A seismic Category I damper should be provided in each duct at the dividing wall. The dampers should be designed to fail open on loss of offsite power or instrument air.

2. Redundant seismic Category I dampers should be provided in the fuel building supply duct, one on each side of the wall separating the fuel building from the auxiliary building. These dampers should be designed to fail shut

on loss of offsite power or instrument air and to shut automatically in the event of a release of radioactivity in the fuel building. The supply duct between the dampers should also be designed to Quality Group C and seismic Category I criteria.

3. The exhaust stack radiation monitors should be relocated, and the primary plant exhaust system modified as necessary to provide automatic isolation of the normal exhaust flow path before the first contaminated airborne particles and gases reach the exhaust plenum in the event of a release of radioactivity in the fuel handling, auxiliary or safeguards building. The radiation monitors and associated ducting and controls should be designed to Quality Group C and seismic Category I criteria.

Based on our review of the design of the fuel handling building ventilation system, we conclude that, after incorporation of the above-listed modifications, it meets the single failure criterion and the guidelines of Regulatory Guide 1.29 and, therefore, is acceptable.

9.4.3 Auxiliary Building and Radwaste Area Ventilation System

The function of the auxiliary building (controlled access area) and radwaste area ventilation system is to maintain suitable and safe ambient conditions for operating equipment and personnel during normal plant operation and to maintain a slightly negative pressure with respect to the environment during all modes of operation. During normal operation, air supply and exhaust is provided by the primary plant ventilation system. After a loss of offsite power or following a design basis accident, a slightly negative pressure is maintained in the building by securing the nonsafety-related supply system and exhausting the air via the engineered safeguards features (ESF) exhaust filtration units. Emergency fan coil units are provided to cool the component cooling water pump rooms and charging pump rooms under accident conditions. The emergency fan coil units are discussed further in section 9.4.4 of this Safety Evaluation report.

The supply ducts and primary plant ventilation supply system components are all classified as nonnuclear-safety grade. However, the supply ducts are designed to remain in place during a safe shutdown earthquake and thus not pose a hazard to safety-related equipment. The auxiliary building and radwaste area exhaust system is of seismic Category I and Quality Group C design up to the exhaust filtration units fan discharge. The primary plant exhaust filtration units and ESF exhaust filtration units are designed to Quality Group C and seismic Category I criteria. The auxiliary building and radwaste area ventilation system, including the primary plant ventilation system and ESF exhaust filtration uints, is located within the auxiliary building which is a seismic Category I structure. The inlet louvers and associated ducting are designed to seismic Category I requirements and are designed to withstand tornado loads and tornado-generated missiles.

The redundant ESF exhaust filtration units are powered from separate Class 1E emergency buses. In general, a single failure in the auxiliary building and radwaste area ventilation system will not preclude performance of its safety function. However, it has not been verified that the safety-grade portions of the ventilation system will be able to maintain a negative pressure in the auxiliary building if supply air flow is not isolated from the nonsafety-related ventilation supply system on loss of offsite power. In addition, failure of auxiliary building exhaust damper CRX-VADPOC-77 in the closed position could prevent flow to the exhaust filtration units and subsequent loss of the negative pressure in the building. Also, failure of damper CPX-VADPOC-83 in the closed position would block flow to the suction of the ESF exhaust filtration units with similar consequences.

The applicant should make the following modifications to the auxiliary building and radwaste area ventilation system:

1. Dampers should be provided in the air intake louvers in the auxiliary building and they should be designed to fail shut on loss of offsite power or instrument air and to shut automatically in the event of a release of radioactivity in the areas served by the primary plant ventilation system. The dampers and upstream ducting should be designed to Quality Group C and seismic Category I criteria. Alternatively, the applicant should verify that a single ESF exhaust filtration unit is adequate to maintain a negative pressure in any area served by these units even if the ventilation supply to these areas is not blocked.

2. To ensure exhaust flow capability to the ESF exhaust filtration units, redundant exhaust ducts should be provided from the auxiliary building to a header upstream of the primary plant exhaust air intake plenum. Each exhaust duct should be provided with a damper designed to Quality Group C

and seismic Category I criteria and designed to fail open on loss of off-site power or instrument air. A branch duct should be provided from the header upstream of the dampers directly to the suction of the ESF exhaust filtration units such that a flow path is available to these units even in the event of a single active failure in the exhaust system.

Based on our review of the design of the auxiliary building and radwaste area ventilation system, we conclude that, after incorporation of the above-listed modifications, it meets the single failure criterion and the guidelines of Regulatory Guide 1.29 and, therefore, is acceptable.

9.4.4 Safeguards Building Ventilation System

The safety-related portions of the safeguards building ventilation system include parts of the engineered safety features ventilation system and the electrical areas fan cooling units. The function of the engineered safety features ventilation system is to provide suitable ambient conditions for personnel and equipment and to maintain the mechanical equipment areas of the safeguards building at a negative pressure with respect to the environment. The electrical areas ventilation system safety function is to cool the safeguards electrical areas in the event of a loss of offsite power or a loss-of-coolant accident. The normal ventilation for the mechanical equipment areas is provided by the primary plant ventilation system; during a loss of offsite power or loss of coolant accident a negative presssure is maintained by the engineered safeguards features (ESF) exhaust filtration units. The primary plant ventilation system and ESF exhaust filtration units are discussed in section 9.4.2 and 9.4.3 of this Safety Evaluation Report. Cooling for both the mechanical and electrical equipment areas is provided by fan coil units in the event of a loss of offsite power or loss of coolant accident.

The exhaust ducts for the mechanical equipment areas are designed to Quality Group C and seismic Category I criteria as are the ducts associated with the fan coil units in the electrical areas. All other ducting and ventilation equipment in these areas are designed to remain in place during a safe shutdown earthquake and thus will not pose a hazard to safety-related equipment. The emergency fan coil units in the safeguard building are designed to Quality Group C and seismic Category I criteria as are the fan coil units discussed in sections 9.4.2 and 9.4.3 of this Safety Evaluation Report for the fuel building and auxiliary building, respectively. Each emergency fan coil unit that must operate in the event of a loss of offsite power or loss of coolant accident is powered from the same Class

1E emergency bus as the equipment it serves. Each emergency fan coil unit is designed to start simultaneously with the equipment it serves. Cooling for the emergency fan coil units is provided by the safety-related chilled water system discussed in section 9.4.5 of this Safety Evaluation Report.

In general, a single failure of the safeguards building ventilation system will not preclude performance of its safety function. A single failure of any emergency fan coil unit, its power supply or its cooling water supply will not preclude performance of the essential functions needed for safe shutdown or accident mitigation in the event of a loss of offsite power or loss of coolant accident. Separate and redundant emergency fan coil units are provided for redundant divisions of essential equipment. However, it has not been verified that the safety-grade portions of the ventilation system will be able to maintain a negative pressure in the controlled access areas of the safe building if supply air flow is not isolated. In addition, the exhaust system drawings do not indicate an available flow path to the suction of the ESF exhaust filtration units; the only exhaust flow path shown is to the primary plant exhaust air intake plenum.

The applicant should make the following modifications to the safeguards building ventilation system:

1. Redundant Quality Group C, seismic Category I dampers should be provided in the safeguards building supply duct, one on each side of the wall separating the safeguards building from the auxiliary building. These dampers should be designed to fail shut on loss of offsite power or instrument air and should shut automatically in the event of a release of radioactivity in the safeguards building. The supply duct between these two dampers should be designed to Quality Group C and seismic Category I criteria. Alternatively, the applicant

should verify that a single ESF exhaust filtration unit is adequate to maintain a negative pressure in any area served by these units, even if the ventilation supply to these areas is not blocked.

2. To ensure exhaust flow capability to the ESF exhaust filtration units, the safeguards building exhaust header should be relocated to feed directly to the suction of these units. The safeguards building exhaust flow to the primary plant exhaust air intake plenum should pass through isolation damper CPX-VADPOC-83.

Based on our review of the design of the safeguard building ventilation system, we conclude that, after incorporation of the above-listed modifications, it meets the single failure criterion and the guidelines of Regulatory Guide 1.29 and, therefore, is acceptable.

9.4.5 Miscellaneous Building Ventilation and Cooling Systems

The safety-related portions of the miscellaneous building ventilation and cooling systems consist of the service water intake structure ventilation system, the diesel generator building ventilation system, the battery room exhaust system, the plant ventilation discharge vent and the safety chilled water system.

The service water intake structure ventilation system maintains the safety-related service water pump area temperature low enough to permit continuous operation of the service water pumps. The service water intake structure ventilation system is designed to Quality Group C and seismic Category I criteria and consists of eight 50-percent capacity exhaust fans along with their associated ducting and dampers. There is adequate redundancy in equipment and Class 1E power supplies to assure operation of at least one service water pump per reactor unit for all modes of operation. The exhaust fans can be manually started on an emergency bus in the event of a loss of offsite power or loss of coolant accident. Individual exhaust fans are started by the operator in response to a service water pump area high temperature alarm in the control room. Outside air is drawn through grated openings in the floor of the intake structure near the base of the service water pump motors. The system is located in a seismic Category I structure which provides protection against tornadoes and tornado-generated missiles.

The diesel generator building ventilation system is designed to maintain the diesel generator room temperature low enough for continuous operation of the diesel generators and to provide outside air for diesel combustion. Each diesel generator room is provided with a full-capacity ventilation system consisting of intake and exhaust louvers and an exhaust fan. The system is designed to Quality Group C and seismic Category I criteria and is powered from the same safety-related electrical bus as the diesel that is serves. The diesel generator building ventilation system is located in a seismic Category I structure and is protected from the effects of tornadoes and tornado-generated missiles.

The battery room exhaust system is designed to ensure a minimum number of air changes per hour in the battery rooms to keep the hydrogen concentration in the rooms below the lower flammability limit. Each battery room is provided with a separate exhaust system consisting of two full-capacity centrifugal fans and their associated dampers and ducting. One fan per battery room operates continuously; the standby unit is automatically actuated on receipt of an operating fan differential pressure trip signal. Failure to start is alarmed in the control room. The battery room exhaust system is designed to seismic Category I and Quality Group C criteria and is located in a seismic Category I structure. The roof exhaust vent is protected against the effects of missiles.

The plant ventilation discharge vents, while not themselves safety-related, are the discharge paths for the safety-related ventilation systems serving the fuel building, auxiliary building and radwaste area, and the safeguards buildings. The applicant has not provided an adequate description of these vents to provide assurance that their failure would not obstruct exhaust flow from the safety-related ventilation systems. Obstruction of exhaust flow could preclude the maintenance of a negative pressure, relative to the environment, in the fuel building, auxiliary building and radwaste area, and safeguards building.

The safety chilled water system provides cooling water to the fan cooling units which remove heat from the compartments housing engineered safeguards features pump motors and electrical switchgear. The safety chilled water system for each reactor unit consists of two 100-percent capacity chillers, two 100-percent capacity chilled water recirculation pumps, a surge tank and the associated fan coil units, piping, valves and instrumentation. The chillers and recirculation pumps are separated into two redundant trains; the chiller condenser for each train is cooled by the respective train of the essential portion of the component cooling water system. Each train of the safety chilled water system is powered from independent Class 1E emergency buses. One surge tank is shared by the two chilled water trains, but the surge tank partition assures an independent surge volume for each train.. The safety chilled water system is sufficiently redundant to assure an adequate supply of chilled water in the event of a single failure for all modes of plant operation. However, since redundant recirculation pumps and chillers are located in the same compartment, there is a concern that a pipe crack or internally-generated missile could incapacitate redundant trains of the safety chilled water system. The system is designed to Quality Group C and seismic Category I criteria and is located within seismic Category I structure which offer protection against tornadoes and tornado-generated missiles.

The applicant should provide the following information to demonstrate the acceptability of the plant ventilation discharge vent and safety chilled water system:

1. Verification that the design of the plant ventilation vent will ensure that the vent cannot fail so as to obstruct flow from the engineered safety features exhaust filtration units.

2. Verification that a pipe crack or internally-generated missile cannot disable both trains of the safety chilled water system.

Based on our review of the design of the miscellaneous building ventilation system, we conclude that, except for the plant ventilation discharge vent, they meet the single failure criterion and the guidelines of Regulatory Guide 1.29

and, therefore, are acceptable. We will report on the acceptability of the plant ventilation discharge vent and safety chilled water system in a supplement to this Safety Evaluation Report.

10.3 Main Steam Supply System

10.3.1 Design

The function of the main steam supply system is to convey steam from the steam generators to the high-pressure turbine, and other auxiliary equipment for power generation. A main steam line from each of the four steam generators conveys the steam to the high-pressure turbine. Each main steam line contains a main steam isolation valve upstream of the pressure equalizing header that connects the main steam lines. The portions of the main steam lines from the steam generators, out through containment, and up to the first moment restraint beyond the main steam isolation valves are Quality Group B and seismic Category I.

The main steam isolation valves, the integral bypass valves and bypass piping are Quality Group A and seismic Category I. The main steam isolation valve actuators are Quality Group B. The main steam isolation valves and bypass valves are designed to close in five seconds upon receipt of a main steam isolation valve closure signal. The isolation valves and bypass valves are designed to stop flow from either direction. Failure of one main steam isolation valve to close, coincident with a steam line break, will not result in the uncontrolled blowdown of more than one steam generator. The initiation and control of main steam isolation is redundant and electrically and physically separated.

Seismic Category I, Quality Group B safety valves and power-operated relief valves are provided for each steam generator immediately outside the containment structure upstream of the main steam isolation valves. The power-operated relief valves are air-operated and fail in the closed position on loss of air

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¶ The applicant should provide remote manual operation of the power-operated relief valves from the control room using only safety-grade mechanical and electrical systems. Alternatively, the applicant should demonstrate by operational testing that controlled safe plant cooldown can be accomplished by manual operation of the dump valves using the existing handwheels. Local manual operation of the dump valves will be acceptable if the following criteria are met:

1. It is demonstrated that the plant can be maintained in a safe hot standby condition, assuming loss of offsite power, without reliance on dump valve manual operation for at least one-half hour following reactor shutdown.

2. It is demonstrated that an operator has good access to the dump valves, can safely operate it manually, and can

INSERT "A" - TO §10.3.1

communicate with the control room.

3. It is demonstrated that manual operation of the dump valves can be performed to support an orderly shutdown with the minimum shift personnel permitted by Technical Specifications.

4. A test is included in the plant test program to verify the ability to achieve safe plant cooldown with local manual dump valve operation.

supply. Thus, the power-operated relief valves cannot be operated from the control room in the event of loss of offsite power or failure of the compressed air supply systems. Although handwheels are provided for local manual operation of the power-operated relief valves, it has not been verified that these valves could be operated manually in time to support shutdown of the plant if required.

REPLACE WITH INSERT "A"

~~The applicant should verify that the power-operated relief valve are accessible, and that sufficient manpower would be available assuming minimum shift personnel, such that these valves can be operated manually in time to support plant shutdown in the event of loss of offsite power or failure of the compressed gas systems.~~

Based on our review, we conclude, upon satisfactory resolution of the power-operated relief valve concern, that the main steam supply system design, up to and including the main steam isolation valves, is in conformance with the single failure criterion, the position of Regulatory Guide 1.29 related to seismic design, and main steam isolation valve closure time requirements and is, therefore, acceptable.

10.4.5 Circulating Water System

The circulating water system associated with each reactor unit is designed to remove the heat rejected from the main condenser, auxiliary condensers, turbine plant cooling water heat exchanger, and condenser exhausting vacuum pump heat exchangers. The heat sink and water supply for the circulating water system is the Squaw Creek Reservoir. The circulating water system is not required to maintain the facility in a safe shutdown condition [illegible] mitigate the consequences of accidents.

Failure of the main condenser circulating water expansion joint can cause rapid flooding of the turbine building sump. The primary means for detecting such a leak would be an alarm in the control room of turbine building sump high water level. The applicant has not provided an analysis to adequately demonstrate that an expansion joint failure would not flood safety-related equipment. Flooding confined to the turbine building would have no adverse consequences to plant safety as no safety-related equipment is located in the turbine building. However, it is not clear that an expansion joint failure, if not isolated in a timely manner, would not cause flooding of safety-related equipment in the electrical and control building, auxiliary building or safeguard buildings. Flooding above elevation 778 feet would flood equipment in the central portion of the electrical and control building. The flood protection afforded the safety chilled water system equipment on this elevation by the compartment walls has not been addressed by the licensee. Flooding above elevation 790 feet 6 inches could affect safety-related equipment on this elevation of the auxiliary building, and, via direct access from the auxiliary building, safety-related equipment in the safeguards building.

The applicant should provide the results on an analysis to demonstrate that flooding caused by failure of the main condenser circulating water expansion joint can be terminated before safety-erlated equipment would be disabled. We will provide resolution of this item in a supplement to this Safety Evaluation Report.

10.4.7 Condensate and Feedwater Systems

The condensate and feedwater systems were reviewed on the basis that their failure should not result in the loss of any essential equipment and should not affect safe shutdown of the facility. They were also reviewed to assure that adequate isolation is provided for these systems where they connect to seismic Category I systems and that system design minimize the potential for hydraulic instabilities.

The only safety-related portions of the condensate and feedwater systems are the condensate storage tank and part of the feedwater system. The condensate storage tank is discussed in section 9.2.4 of this Safety Evaluation Report. The safety-related portion of the feedwater system is designed to Quality Group B and seismic Category I criteria and extends from the steam generator nozzle back to and including the check valve upstream of the containment isolation valve. Each individual main feedwater line to a steam generator incorporates a feedwater bypass system whose function is to minimize the potential for water hammer. The feedwater bypass system is also Quality Group B and seismic Category I. Feedwater system isolation valves and feedwater bypass system isolation valves are automatically closed to isolate the safety-related portion of the feedwater system upon receipt of a steam generator high-high level signal, a safety injection signal or a low average temperature signal with reactor trip.

The applicant has stated that the geometrical configuration of the main feedwater system will preclude the occurrence of serious flow instability (waterhammer) in the feedline. The main feedwater inlet nozzle is located close to the steam generator tubesheet and a feedwater bypass system has been provided to minimize the potential for waterhammer. The applicant will provide a test report to demonstrate the adequacy of the feedwater configuration to reduce or eliminate water hammer.

We have reviewed the design of these systems and conclude that adequate isolation is provided between seismic Category I portions and nonsafety-related systems. We also conclude that failure of the condensate and feedwater systems will not affect safe shutdown of the facility. We will discuss the adequacy of the design to minimize water hammer in a supplyment to this Safety Evaluation Report after staff review of the test report to be submitted by the applicant.