Docket File

JUL 2 5 1973

DISTRIBUTION:
Docket File
L Reading
L:CS
L:APCSB

Docket Number 50-346

Richard C. DeYoung, Assistant Director for Pressurized Water Reactors, L

REQUEST FOR ADDITIONAL INFORMATION, AUXILIARY AND POWER CONVERSION SYSTEMS BRANCH

Plant Name: Davis-Besse Nuclear Power Station, Toledo, Edison
Licensing Stage: OL
Docket Number: 50-346
Responsible Branch: PWR #4
Project Manager: Irving A. Peltier
Requested Completion Date: July 6, 1973
Applicant's Response Date: October 12, 1973

The Auxiliary and Power Conversion Systems Branch has completed a review of the Davis Besse Nuclear Power Station, FSAR. The enclosed request for additional information covers those portions of the FSAR for which this branch has primary responsibility. We find that additional information will be necessary to complete our evaluation of the safety related systems.

In responding to the attached questions, the applicant should provide sufficient description matter and details to allow an understanding of the various systems and the capability to function without compromising directly or indirectly the nuclear safety of the plant under both normal operation or transient conditions. Emphasis should be placed on those aspects of design and operation that affect the reactor and its safety features or contribute toward the control of radioactivity and that all pertinent criteria are met.

It is our understanding a recent visit by the Site Analysis Branch personnel indicates the use of the firing ranges east of the site will not affect the safety of the Davis-Besse facility and therefore we have not considered possible missiles from these sources.

Robert L. Tedesco, Assistant Director
for Containment Safety
Directorate of Licensing

Enclosure:'
As stated

8002030119

OFFICE ▶						
SURNAME ▶						
DATE ▶						

JUL 25 1973

Richard C. DeYoung -2-

cc: (w/o encl.)
A. Giambusso
W. McDonald

(w/encl.)
S. H. Hanauer
J. M. Hendrie
A. Schwencer
I. Peltier
C. G. Long
J. Glynn
D. Fischer
A. R. Ungaro

OFFICE ▶	L:CS:APCSB	L:CS:APCSB	L:CS			
SURNAME ▶	A.R. Ungaro ARUngaro:jr	C. Long	R. Tedesco			
DATE ▶	7/24/73	7/24/73	7/24/73			

DAVIS BESSEE NUCLEAR POWER STATION

REQUEST FOR ADDITIONAL INFORMATION

3.3.2 Tornado Criteria

1. The FSAR provides a description of design-basis tornado borne missiles considered for this facility. Expand the spectrum of tornado missiles considered to include the following assuming that the tornado has 300 m.p.h. rotational and wind velocity plus a 60 m.p.h. translational velocity:

   (a) 4" x 12" plank x 12 ft long with a density of 50 lbs/ft^3;

   (b) Utility pole 13.5" diam. x 35 ft long with a density of 43 lbs/ft^3;

   (c) 1" solid steel rod 3 ft long with a density of 490 lbs/ft^3;

   (d) 6" schedule 40 pipe, 15 ft long with a density of 490 lbs/ft^3; and

   (e) 12" schedule 40 pipe, 15 ft long with a density of 490 lbs/ft^3.

   (f) 3" schedule 40 pipe, 15 ft long with a density of 490 lbs/ft^3.

Present the following information for each of the above:

   (a) The maximum velocity attained.

   (b) The required thickness of a reinforced concrete missile barrier to stop the missiles without their penetrating the missile barrier or creating secondary missiles, (assuming an end-on impact, i.e., the minimum impact area).

In developing the above information, assume the missiles do not tumble and are at all times oriented such as to have the maximum value of $\frac{C_d A}{W}$ while in flight. Clearly define the other analytical model and assumptions that you have used. Since the potential destructive forces that can be developed varies with the elevation difference between where the missile originated and its impact area, present the above information for missiles originating at ground level and at increasing elevations in increments of 50 feet up to the highest structural elevation on the site.

2. With the aid of site plot plans and layout drawings, identify and locate all essential systems and components that are required in order to attain a safe shutdown in the event of a tornado, including all control, sensing, power and cooling lines. Using the missile barrier thicknesses developed in response to Question 3.3.2.1(b) above, discuss the adequacy of all tornado missile barriers protecting the essential systems.

3. Provide the bases for all safety related components or systems required for safe shutdown that will not be protected by missile barriers. Provide a list of these essential components or systems.

4. Describe the method of venting the auxiliary building in order to keep the differential pressure drop within the 1.5 psi design limit. Provide the criteria and assumptions used and elaborate by means of sketches in sufficient detail to demonstrate the effectiveness of the venting techniques. Relate your response to the time function in reference to the venting technique using as a basis the 3 psi drop in 3 sec.

3.4 Water Level (Flood) Design Criteria

1. Provide a list of all seismic Category I systems and equipment that are located below elevation 583.5 feet (MSL).

3.5 Missile Protection

1. Assuming and end-on impact of the missiles identified in Tables 3 and 4 of Section 3.5.4 and 5, missiles to be considered under Section 3.3.2.1 above, and other potential missiles, provide additional information on the ability of the barriers provided in preventing penetration and creation of secondary missiles.

2. Aside from the missile discussion in Section 3.5 regarding measures taken to protect the containment from both internal and external missiles, it is not clear what other steps have been taken to protect the remaining parts of the plant from missiles. To clarify this point, provide the following:

   (a) Identify all internal and external missiles capable of being developed at the plant site from rotating equipment and pressurized containers.

   (b) For each of the above possible missile sources, indicate, with the aid of drawings, its location in relation to seismic Category I structures, safety related systems and associated components.

   (c) Indicate the size, weight and maximum kinetic energy contained by the most destructive missile from each of the above sources.

   (d) For each of the above missiles, discuss the extent of the protective measures taken and design features employed to protect all essential safety related items required for safe shutdown.

8.3 Outside Power Systems

The information contained in this section is not in sufficient detail to perform an evaluation of the Diesel Generator and associated safety related systems. Please expand this area and provide the design details, diagrams and other pertinent information that justifies that the design meets criteria that are stated.

1. Diesel jacket water cooling is provided by the component cooling water system. In the event of loss of power, there will be an interruption in the power supply to the component cooling water pumps coincidental with diesel start. Considering component cooling water pump flow coast down and restart of the pumps, discuss the effect on the cooling water flow, and what effect (if any) it will have on the performance of the diesel generators. What procedures will be used to maintain the diesel generators on-line during this interval?

2. Provide a discussion of the installed protective type devices that are incorporated in the design to protect the diesel generators from exceeding operating limits or otherwise prevent them from performing their intended function during a DBA. What measures will be taken to minimize the possibility of the above devices from needlessly preventing the diesel from operating when required?

3. Describe the measures taken to assure fast and reliable starting of the diesel engines, with respect to maintaining minimum jacket cooling water and lubricating oil temperatures.

4. The description and physical arrangement of essential subsystems for the diesels have not been adequately described. Provide a description of the design including arrangement drawings and diagrams for the following subsystems:

(a) The air intake structure and filtering system.

(b) Lubrication and its filtering system,

(c) cooling water and its sources,

(d) the fuel oil filtering system, and

(e) the batteries and starting systems.

5. The FSAR states the fuel oil storage tank and the fuel oil transfer system are not designed as Class IE structures within the meaning of IEEE-308. Please clarify this statement. Explain how you propose to maintain the diesel generator in operation for a minimum of 7 days to assure safe shutdown and maintenance of post-shutdown or post-accident station security.

6. Describe the seismic Category I auxiliary systems which supply the diesel generator building. The response should specifically address (a) freeze protection upon loss of auxiliary boiler heating service in winter, and (b) ventilation to prevent overheating or loss of power to the fans serving the compartments during diesel operation in summer.

7. The FSAR states the diesel engine day tank capacity is sufficient for approximately 24 hours at 110% full load operation. Provide a discussion of the factors considered in arriving at this capacity. Include in the discussion the range of malfunction considered, and the time interval between the low level alarm and when the day tank will be empty. Relate the time period required to carry out the various remedial actions to the time period available.

8. With the aid of general arrangement drawings of that part of the auxiliary building housing the diesel generators, and their associated auxiliary systems, provide the results of a failure mode and effects analysis for each individual diesel generator auxiliary system. The results of the analysis should demonstrate that it is not possible for one single event to disable more than one diesel

generator. Include in your discussion and analysis events such as fires, flooding. external and internal missiles (i.e., crankcase door missile created by a crankcase explosion or a failure in one of the air receiver systems).

9.0 Auxiliary Systems

9.01 In regard to potential failures or malfunctions occurring due to freezing, icing, and other adverse environmental conditions for those components not housed within temperature controlled areas and which are essential in attaining and maintaining a safe shutdown, identify and discuss the protective measures taken to assure their operation.

9.02 Provide a tabulation of all valves in the reactor pressure boundary and in other seismic Category I systems, as recommended in Regulatory Guide 1.29, e.g., safety valves, relief valves, stop valves, stop-check valves, control valves whose operation is relied upon either to assure safe plant shutdown or to mitigate the consequences of a transient or accident. The tabulation should identify the system in which it is installed, the type and size of valves, the actuation type(s), and the environmental design criteria to which the valves are qualified, as stated in the design specifications.

9.03 For all vessels that contain gas under pressure (such as nitrogen, chlorine, hydrogen, oxygen, air and CO_2 tanks) provide the following: (a) The design and operating pressure, (b) the maximum pressure of the gas supply, (c) the location of the vessel, (d) the total energy released if the largest pipe connected to the vessel should rupture, (e) the protective measures taken to prevent the loss of function of adjacent equipment essential for a safe and maintained reactor shutdown, (f) for each vessel identify, discuss and supply the basis for any exceptions or deviation that will be taken to the positions set forth in the Occupational Safety and Health Administration OSHA 29 CFR 1910.

9.1.0 Fuel Storage and Handling

1. Provide the following additional information regarding the new fuel storage pit:

   (a) An evaluation of design loading that includes all external loads and forces, including handling.

(b) Additional description of the storage pit including materials of construction, design codes and standards, seismic classification and the effect of adjacent equipment failure.

2. Provide a more detailed description of the spent fuel operations involved during the transfer of fuel from pool to the cask and the cask to loading area in the pool. Also the arrangement of the fuel pool unloading area that prohibits the fuel cask from being moved over the spent fuel pool as stated in Section 9.1.2.3.

3. Provide the following for the spent fuel pool cooling and cleanup system:

(a) The spent fuel pool water quality requirements including the maximum allowable corrosion and fission products and the bases for determining when the use of the cleanup demineralizer is needed and a description of the operations needed to bring it on and off line including isolation capabilities of the system.

9.1.3 Spent Fuel Pool Cooling and Cleanup System

9.1.3.1 The spent fuel cooling system is designed to maintain the borated spent fuel pool water at approximately 100°F for a heat load based on the decay heat generated from 1/3 of the core fuel assemblies which have undergone infinite irradiation and have been cooled in the reactor for 150 hours prior to being transferred to the pool. The total storage capacity of the spent fuel pool is, however, designed for 1-1/3 core plus 24 spare locations. The cooling capacity for this additional core must be provided by the decay heat removal system. In view of the system design and the nature of the engineered safety functions of the decay heat removal system, please clarify and/or provide information on the following items:

1. Clarify the bases for the temporary connections between the spent fuel cooling system and the decay heat removal system; also provide information to justify the position for using single isolation valves between these two systems.

2. Present information to demonstrate that a power failure during refueling or spent fuel handling operations will not create hazardous condition.

3. Indicate the seismic and safety design classification for this system and discuss the possibility of complete loss of cooling. In light of common suction line and discharge line for both the spent fuel cooling pumps, the occurrence of such incident cannot be considered as remote.

4. Specify operating restrictions which will be imposed on the reactor when the RHR system is interconnected with and performing the cooling function for the spent fuel cooling system.

5. Describe the instrumentation and controls provided for the spent fuel pool, specifically for radiation, water level and component failure. Provide the level at which alarms are actuated and describe the action taken for each should they alarm.

6. Describe the procedure and the associated pumps, piping and valves used to supply the spent fuel pool with a seismic Category I make-up source from the borated water storage tank and/or other emergency supply.

7. Describe, with the aid of Figure 9-3A and other details, the spent fuel storage racks and their arrangement in the pool. Include the design basis and the ability of the racks to withstand external loads, including seismic loads and impact forces due to dropped objects (indicate the largest object to be handled over the spent fuel pool).

8. In addition to Figures 1-6, 1-7, 9-26 and 9-27 provide additional plans and elevations showing dimensioned details of the fuel storage (new and spent fuel) and cask loading pools.

9. Provide a list of all major tools and servicing equipment necessary to perform the various reactor vessel servicing and refueling functions and indicate whether each is designed to seismic Category I requirements or their storage locations are designed to these requirements.

10. Describe in detail the applicable codes and standards used in the design, fabrication, installation and testing of crane, rails, supporting structures, bridge, trolley, hoists, cables, lifting hooks, special handling fixtures and slings.

11. Provide the tensile properties for the hook and eye and discuss the margin of safety in terms of yield strength. Also provide data on sheave size and wire rope performance, and discuss redundancy (if provided) for hoist, motors, controls, brakes and other features of the cranes. Describe in detail the cab and pendant control features.

12. For each crane, list its design load rating preoperation test load, maximum operating loads and the test loads that will be used throughout the life of the facility.

13. Describe the modes of failure that were considered in the design of the spent fuel cask crane and reactor polar crane such as breaking of cables, lifting slings, sheared shafts, keys, stripped gear teeth, and brake failures. Also discuss the limitations and control that will exist in handling objects over an opened reactor vessel.

14. Since the primary system arrangement represents a departure from previous B & W design, provide an analysis of the consequences of dropping the following objects from their maximum drop heights:
    (a) The reactor vessel head onto an opened reactor vessel.
    (b) The upper core barrel assembly in an opened reactor vessel.

    The evaluation should consider the maximum lift point required to remove or install the components cited above. Provide drawings and sequences of lifting operations to illustrate the evaluation. Evaluate the yield and shear strengths of the vessel support for the postulated head drop.

15. Describe and discuss the operating practices, qualifications and training of the people who will operate and/or direct the operation of the reactor and turbine building cranes. As a guide, use the Chapter 2-3.1 Operation - Overhead and Gantry Cranes USAS - B-30.2-1967 as developed by the American National Standard Safety Code for Cranes, Derricks, Hoists, Jacks and Slings.

16. What are the geometric changes of load position that may occur in the event of malfunction or failure in the hoisting system (the hoisting system includes the load and all items of mechanical and structural support on the bridge trolley)? Provide an evaluation of the effects of these geometric changes on the fuel handling and storage area and any other safety related equipment.

17. Discuss the degree of compliance of the reactor building polar crane and cask crane with OSHA Subpart N Materials Handling and Storage of 29 CFR 1910, Section 1910.179. Identify, discuss and provide a basis for any exceptions and/or deviations taken.

18. Describe and discuss the plans and means provided to absorb the resulting impact should the spent fuel cask be dropped in the spent fuel pool or cask pool. The discussion and analysis should include:
    (a) An outline drawing of the cask, cask dimensions, and center of gravity.
    (b) The cask weight, assumed drop height, deceleration distance, deceleration force versus stroke, velocity at impact considering deceleration caused by the pool water.
    (c) The maximum possible drop height.

(d) The means, aside from administrative control, to limit the drop height to that assumed in the analysis.

(e) A description of an energy absorbing device (if used) and the vendor identification should it be commercially available.

(f) The possible modes of failure of the energy absorbing device and the inspections and surveillance to be carried out prior to each time a potential for a cask drop exists.

(g) Information which demonstrates that the cask cannot be tipped before being dropped and/or that the energy absorbing system is adequate even if it is dropped in the tipped condition.

(h) The individual and combined static and dynamic concrete and reinforcing steel stresses of the fuel pool structure when the pool is subjected to its maximum normal anticipated loads as well as those experienced during impact. Also, the dynamic properties of the pool structure that are essential in establishing the dynamic stresses should be included in this discussion.

19. Provide an evaluation of how the Regulatory Positions set forth in Regulatory Guide 1.13 "Fuel Storage Facility Design Basis" were implemented. Indicate the areas of agreement with the guide and in the cases of differences, provide justification regarding acceptability of the proposed design.

20. Prove an outline of the cask handling procedure including a sketch or drawing which shows the routing of the spent fuel handling cask from receipt to the pool for loading with spent fuel to its return to the transporting car ready for shipment from the nuclear plant.

9.2.1 Service Water System

1. Provide plan elevation and section(s) drawing(s) of service water pump room. On the elevation and section drawing, provide the arrangement of the pumps, important dimensions and the minimum and extreme high water levels including the PMF.

2. Figure 9-2 indicates a single 30" service water return header through the service water tunnel. The diagram also indicates the cooling water outlets from the containment air coolers are manifolded into a single 8" return line connecting to the 30" return header. Similarly the cooling water outlets from the component cooling water heat exchangers are manifolded into a single 18" return header also connecting to the 30" return header. What are the consequences if a line break occurs immediately after the point of manifold in the 8" or 18" return lines mentioned above, or a break in the 30" service water return header inside the service water tunnel? With the aid of drawings or diagrams, discuss which essential systems would be rendered inoperable due to flooding. Include in your discussion the consideration given to passageways, pipe chases, cableways and all other possible flow paths joining the flooded space or other spaces containing essential systems and components. Discuss the effect of flooding waters on all submerged essential (electrical/mechanical) systems and components. Discuss what provisions have been made in the design to alert the control room operator in the event of system leakage or rupture.

9.2.2 Component Cooling Water System

1. Figure 9-4 indicates a single failure in the component cooling water supply line to the reactor coolant pumps can deprive the pumps of cooling water. Provide the following information:
   (a) How long could the reactor coolant pumps operate at power without seizure of all pumps occurring after loss of coolant as postulated above.
   (b) How long would they operate at power before the sensing devices would cut power to the pump motors.
   (c) How long would they continue to rotate once power has been cut off?

(d) Describe the sensing and associated circuitry to cope with the above situation in sufficient detail to form a valid basis of its acceptability and to assure that power to the reactor coolant pumps will be cut-off; also describe the design features which assures that it will remain functionally operable even when experiencing single failures.

(e) Assuming the loss of cooling water and that the power to the reactor coolant pumps was not cut off, provide a discussion and description of the most adverse situation that could follow the seizure of all reactor coolant pumps.

2. Identify all components that have a single barrier between the component cooling water system and the reactor primary coolant system e.g., RHR heat exchangers.

(a) Indicate the design pressure and temperature requirements of the barriers confining the primary coolant in the above components.

(b) Indicate the operating range of the primary coolant temperature and pressure in the above components.

(c) In those cases where the pressure and temperature design requirements of the barriers in the above omponents are less than reactor coolant operating pressure and temperature:

(1) indicate the operating modes during which these components are in use and the range of pressures and temperatures of the the reactor primary coolant during these modes;

(2) describe the controls and interlocks provided in detail for the isolation valving between the primary system and the RHR system; and,

(3) for each of the above components, assume a complete failure of the barrier and describe athe consequences to the component cooling water system.

3. Demonstrate that in the event of a system leak or rupture, the component cooling surge tank capacity is adequate to assure a continuous supply of component cooling water to equipment required for safe shutdown until the leak can be isolated. Describe any automatic devices provided to mitigate the effects of system leakage or rupture.
4. In view of the safety related function of the CCWS, discuss, with the aid of drawings and diagrams, the seismic Category I source of make-up to the component cooling water system.

9.2.4 Potable and Sanitary Water System

1. State the design provisions made that preclude the contamination of the plant drinking water and sanitary water from radioactive sources.

9.2.5 Ultimate Heat Sink

1. This section of the FSAR contains design parameters and heat loads utilized in the design of the "Ultimate Heat Sink". On what basis have the heat loads been calculated? Further, a staff review of available information does not support your conclusions that the service water system meets the suggested criteria of Regulatory Guide 1.27 "Ultimate Heat Sink". Your response should provide the following:
   (a) The results of an analysis supporting your conclusions, in sufficient detail to permit an independent review;
   (b) a discussion of how the Regulatory positions set forth in Safety Guide 1.27 were implemented. Identify each exception taken and provide the bases,
   (c) a tabulation and plot spanning a thirty-day period of (1) the total heat rejected, (2) sensible heat rejected, (3) station auxiliary system heat rejected, and (4) decay heat from radioactive material. Use the methods set forth in the October 1971 draft Proposed ANS Standard Decay Energy Release Rates

Following Shutdown of Uranium-Fueled Thermal Reactors to establish the heat input due to the decay of radioactive material. Assume an equilibrium fuel cycle* and increase the calculated heat inputs as follows:

(1) For the time interval 0 to 10^3 seconds, add 20 percent to the heat released by the fission products to cover the uncertainty in their nuclear properties.

(2) For the time interval 10^3 to 10^7 seconds, add 10 percent to the heat released by the fission products to cover the uncertainty in their nuclear properties.

(3) For the time interval 0 to 10^7 seconds, calculate the heat released by the heavy elements (using the best estimate of the production rate for each unit) and add 10 percent to cover the uncertainties in their nuclear properties.

In submitting the results of the analysis requested, include the following information in both the tabular and graphical presentations:

(a) The heat rate and total integrated heat rejected due to the fission product decay heat.

(b) The heat rate and total integrated heat rejected due to the heat released by the heavy elements.

(c) The heat rate and total integrated heat rejected by the Station Auxiliary Systems.

(d) The heat rate and total integrated heat rejected due to sensible heat.

(e) The maximum allowable plant inlet water temperature taking into account: (i) the rate at which the heat must be removed; (ii) the water flow wrate, and (iii) the capabilities of the respective heat exchangers.

(f) The required NPSH for the water pumps (taking the required water flow rates and temperatures into account).

---

* In this regard use the ANS formulation for finite operating time.

(g) The maximum available NPSH for the water pumps.

2. Section 9.2.5.1 states the design of the cooling water system incorporates a seismic Category I return line from the service water system to the intake canal seismic Category I area forebay. Provide the necessary diagrams and design detail drawings including plan and sections of the intake canal and return line and any additional information necessary to permit an independent evaluation of this portion of the ultimate heat sink. Provide similar drawings and other detail information for the intake structure.

3. Provide a legible plot plan of the facility indicating and identifying all essential lines (cooling, power, sensing and control) that pass between seismic Category I structures. Discuss the measures taken to prevent the loss of those lines required to attain and maintain a safe shutdown due to seismic events, missiles from rotating equipment and tornadoes, fires, floods and the collapse of non-seismic structures.

4. In the event of an earthquake, it is assumed that condensate storage and all other class II water systems including the seismic Class II portion of the intake forebay and all Class II structures are not functional. Under this condition, to assure safe plant shutdown, the service water system which is seismic Category I must supply the total heat sink for plant shutdown. The total quantity of water available for this purpose will be that contained within the confines of the intake canal seismic Category I area forebay. aThis volume of water must suffice for emergency feed to the steam generators and for reactor cooldown to shutdown condition and maintain this condition for a 30-day period.

(a) Provide the results of an analysis to substantiate the volume of water entrapped in the seismic Category I area of the forebay is adequate to accomplsih the above function and bring the reactor to a safe shutdown condition.

(b) What effect will the unclarified and untreated Lake Erie water have on the operation of the steam generators when used to cool down the reactor to 280°F? Relate the response to the development program performed for the once through steam generator.

9.2.7 Auxiliary Feedwater System

1. Considering that steam generator (E-24-2) is effected by a main steam line break accident and assuming either normally closed valve HV 608 or HV 106 fails to open (single failure), provide a description of the procedure or a description of the modifications necessary to bring the plant down to a safe condition. Indicate the time interval required to accomplish this function and compare it to the conditions in the primary system.

9.3 Process Auxiliaries

9.3.1 Station And Instrument Air System

1. In view of the fact that the compressed air system is not a safety class system and is not seismically designed, demonstrate that failure of the compressed air system will not render any safety class system components or their functions inoperable. List all air operated valves whose malfunction can affect plant safe shutdown, provide their failure mode and demonstrate that their failure mode will not compromise safe shutdown of the plant.

9.3.2 Process Sampling Lines

1. Have alternate paths been provided to obtain a sample from the reactor system or containment during accident conditions?
2. Provide a list of codes and standards used for that portion of the sampling system that interconnects to seismic Category I systems.

9.3.3 Equipment and Floor Drain System

1. For all components needed for safe shutdown and accident prevention or mitigation, provide a discussion on the floor drainage system serving the area where the equipment is located. The response should include sufficient plan and elevation drawings to disclose the elevation of drains and discharge points as well as the propsed routing of pertinent piping systems. Identify potential sources of water for which a single failure could cause flooding of the areas and, in this event, what effect would it have on the safe shutdown of the plant. Discuss the precautions taken to prevent flooding by the above mentioned sources. Identify the means provided by which the operator will be alerted that water is entering the area, room or component and the methods available for corrective action.

2. Provide additional explanation and assumptions used for the evaluation of the auxiliary building lower elevation drainage system sumps and sump pumps as to their capability to collect excess liquid due to an emergency flood condition.

9.3.4 Make-up and Purification System

1. Section 9.3.4.3.3 states each of the reactor coolant pumps seal injection lines contain a solenoid valve designed to fail closed upon loss of air supply. An air accumulator is provided to keep the valve open in the event of failure of the air supply. How long will the accumulator keep the valve open? What operator action is required upon loss of air supply to avoid reactor coolant pump damage?
2. Provide the maximum allowable temperature for the make-up purification demineralizers mixed bed and cation bed resin and the consequences of exceeding this temperature.
3. In addition to the normal demineralization and filteration system, the make-up flow can be diverted through a pre-filter. Provide the bases for determining when the operator will use this pre-filter.

4. The letdown temperature in the letdown line downstream of the coolers is alarmed and provides an interlock for isolation to protect the purification system. Is the letdown temperature always indicative of the pressure associated with the letdown system? Discuss the effects that the interlock failure would have on the purification system. How would excessive temperature and pressure otherwise be detected?

5. Letdown flow rates are controlled by a fixed block orifice, a parallel remotely operated valve, and a second manually positioned valve also parallel with the block orifice. Discuss the operation of these valves and describe the associated conditions required for operation. Consider also the effects on letdown flow and system presssure with either one of the valves open and with both valves open.

6. In addition to the normal make-up line, two alternate paths for adding boron to the reactor coolant system are identified. Determine the limiting condition for boration and provide the margin associated with the alternate injection method to maintain subcriticality during reactor cooldown.

9.3.5 <u>Decay Heat Removal System</u>

1. During cooldown of reactor coolant from 280°F to 140°F, the pressurizer is cooled by spray from the decay heat removal system. Discuss the effects on the cooldown of a single failure in the single spray line indicated in Figure 6-16.

2. The borated water storage tank is located outside the reactor and auxiliary buildings. In light of the safety function of this tank, provide the following additional information:
   (a) Discuss the effects of the tank heater failure.
   (b) Describe heat tracing requirements for the system.
   (c) Provide the limits of radioactivity concentration in the tank.

(d) Describe the requirement for leak detection and leakage control.

9.3.6 Chemical Addition System

1. Provide an analysis for the chemical addition system to determine the effects of system malfunction or failure on safety related equipment to control the reactor coolant chemistry and shutdown margin.

9.4 Air Conditioning, Heating, Cooling and Ventilating Systems

9.4.1 Control Room

1. Provide a description of the ability of the control room ventilation system to detect air-borne contaminants, specifically smoke and radiation, and preclude their admission to the control room. Include in the description the detection methods, closure times of isolation valves, and time required to expedite the discharge of contaminants from the control room.
2. Describe the heating, ventilating and air conditioning system and controls of the control room and other areas shown in Figure 9-10. Describe the effects of emergency isolation of the control room on the air supply and return systems. Discuss the extent to which this system can operate with any single failure.
3. Provide a description of the smoke detectors used in the ventilation systems and indicate where they will be located with respect to air intakes.
4. State the design ventilation capacities required for the control room, equipment and cable room ventilation systems. This should include flow rates, cooling and heating requirements.
5. Describe the administrative controls necessary to assure that all entrance ways and other openings to the control room are normally closed. Indicate any additional steps required to assure that the pressure differential within the control room is maintained during emergencies.

9.4.2 Auxiliary Building

1. Provide a failure mode and effect analysis for the fuel handling area ventilation system, including the effects of the inability to maintain preferred air flow patterns.
2. For the electrical penetration room, laboratories, and health physics monitor areas, provide a discussion that delineates the anticipated heat loads and their effects on radwaste ventilation system operation.
3. Provide the leakage assumptions that were used in areas housing ECCS equipment and how leakages exceeding the assumed values, up to a rupture of a pipe, will be handled for post-accident conditions.
4. Assuming a radwaste tank rupture (or any other pressure vessel containing radioactive materials) discuss the effects of:
   (a) the pressure pulse on the auxiliary building exhaust system;
   (b) this accident on the capability of the exhaust system to handle this situation and provisions made in the design to prevent contaminants from being delivered to other areas of the auxiliary building by the ventilation systems.

9.4.4 Turbine Building

1. Provide a description of the monitoring instrumentation, isolation capabilities, inspection and testing requirements for the system.

9.5 Other Auxiliary Systems

9.5.1 Fire Protection

1. Describe the potential fire hazards in each plant area and fire protection requirements and discuss the fire risk evaluation utilized in the design of the fire protection system.
2. Provide the results of a failure mode and effects analysis for the fire protection system, including an analysis of potential adverse effects caused by operation of the system. Also provide a discussion relating to the reliability of the fire detection

equipment in terms of sensitivity, mean time between failures, and other operational experiences.

3. Discuss how the design assures that failure of any part of the fire protection system not seismic Category I will not damage or prevent fire protection to a Category I structure, system or component.
4. Describe, with the aid of drawings, the fire detection and protection system provided in the circulating water pump house, turbine room, auxiliary building, transformer areas, diesel generator rooms and all other areas where fire protection is required for the safe shutdown of the plant. For the above areas provide the following information:
   - (a) Describe the principles of operation, calibration and set point of the sensing devices that will detect the fire and automatically actuate the fire dampers in all ducts containing this equipment. Indicate if the operator has the ability to override the automatic controls actuating the fire dampers.
   - (b) Indicate the location and distance between detectors and relate the accuracy and sensitivity of the detectors to the maximum possible size of an undetected fire assuming the flow of ventilation air in the area carries the combustion products away from the detector.
5. Discuss the potential of a fire protection system storage tank rupture and the effects upon safety related systems.
6. Demonstrate with elevation drawings that the fire pump locations are compatible with minimum and maximum supply source levels. State the required and available NPSH at minimum supply levels.
7. Provide a discussion of the precautionary measures taken to prevent the buildup of explosive mixtures of hydrogen and oxygen given off by the batteries.

9.5.4 Diesel Generator Fuel Oil System

1. Provide a description, including drawings, in the FSAR for the sections listed below. These sections are included in Revision 1 of the "Standard Format and Content of SAfety Analysis Reports for Nuclear Power Plants" issued October 1972. In the event the information is included in other sections of the FSAR, provide references where the information may be found.

9.5.5 Diesel Generator Cooling Water System

9.5.6 Diesel Generator Starting System

9.5.7 Diesel Generator Lubrication System

10.0 Steam And Power Conversion Systems

10.1 Summary Description and General Comments

1. Provide the criteria and bases for the various steam and condensate instrumentation systems. The FSAR should differentiate between operating and required safety instrumentation.

10.2 Turbine Generator

1. Describe, with the aid of drawings, the bulk hydrogen storage facility including its location and distribution system. Include the protective measures taken to prevent fires and explosions during operations, such as purging the generator, as well as during normal operation.

2. With regard to Emergency Control Operations:

   (a) identify all monitored paramters, whose signals are utilized in providing assurance that a turbine overspeed condition will either be prevented or will be controlled within acceptable limits;

   (b) identify and describe the associated components that function fupon receipt of its signal in order to prevent or limit turbine overspeed to within acceptable limits;

   (c) for each of the above monitored parameters and associated components, describe and discuss the degree of compliance with each of the items of Section 4 of IEEE-279, Nuclear Power Plant Protection Systems;

   (d) identify and provide the bases for each exception to or deviation from IEEE-279.

10.3 Main Steam Supply

1. Describe the consequences of the reactor system transient expected to occur assuming all power operated relief valves in the secondary system fail to open.

2. Describe the preoperational and periodic functional tests that will be performed to demonstrate that the main steam line isolation, check,

relief and bypass valves will function in accordance with design. Provide similar information for the high pressure feedwater valves.

3. Discuss the basis for the steam line isolation and non-return valve design, leakage rates and accpetance criteria for shop and inplant tests.
4. Figure 10-1 shows isolation valves FV-100 and FV-101 in the main steam lines. Assuming a failure of the main steam line upstream of the isolation valve and the non-return valve fails to close:
   (a) Will the isolation valve maintain the required tightness under this condition?
   (b) What leakages may be expected?
   (c) What leakages may be expected through the isolation valve if the main steam line failure occurred downstream of the isolation valve?
5. Provide a description and design evaluation of the main steam line non-return valves and the inspection and test provisions incorporated into the design. Include in the discussion what effect the failure of this valve has on the mass and energy release to the auxiliary building due to a rupture of that steam line in which it is installed.
6. Provide the criteria and basis of design that has been used to preclude the consequences of postulated high energy piping system ruptures as a result of design basis breaks outside the primary containment from having an adverse effect on safety related structures, systems or components necessary for safe shutdown. Include in the discussion a failure mode and effect analysis of the auxiliary feedwater system during the accident.
7. Describe the location, physical separation, or protective barriers provided the main and auxiliary feedwater pumps to ensure their operation if flooding or gross failure of adjacent components or structures were to occur.

10.4 Steam and Power Conversion Subsystems

10.4.1 Main Condensers and Circulating Water System

1. Provide the location of all safety related equipment located within the turbine building on plan and elevation drawing.
2. Provide elevation drawings showing the water level in the turbine building at various times after a complete rupture of the main condenser circulating water rubber expansion joint. For each time increment discuss which, if any, essential systems and components could be rendered inoperable. Include in your discussion the consideration given to passageways, pipe chases, cableways, and all other possible flow paths joining the flooded space to other spaces containing essential systems and components. Discuss the effect of the flood waters on all submerged essential electrical systems and components.
3. Describe the means provided to detect a failure in the circulating water system and how and in what time interval flow will be stopped, considering all factors, e.g., operator reaction time, drop-out time for control circuitry and coastdown.
4. Indicate the actuation time for all valves in the circulating water system. For each valve indicate the maximum possible closure time assuming the most likely condition to effect this. Indicate the maximum pressure peak that could be experienced due to this failure and relate this to the design pressure of the circulating water system barrier.
5. Provide a description of the chlorine treatment system for the circulating water system, with the aid of drawings:
   (a) the location and maximum inventory of chlorine that will be kept at the site;
   (b) the means of transportation and size of the incoming shipment of chlorine;

(c) the range of adverse conditions that were considered during the design of the chlorine transportation, storage and utilization system;

(d) the precautionary measures taken to prevent accidental release of chlorine;

(e) the means provided to detect the escape of chlorine;

(f) the sensitivity of the detection means in relation to the maximum continuous acceptable concentration of chlorine for operating personnel.

10.4.4 Turbine Bypass System

1. Section 10.4.4.5 states turbine bypass valves can be tested during plant operation. Aside from those opening and closing tests made during the initial startup and shutdown, describe the extent of the tests and the frequency of tests that will be performed during plant operation.

10.4.7 Condensate and Feedwater System

1. Provide a description and discussion of the potential and consequences of a condensate line rupture in the turbine building or other structures housing portions of the system. The discussion should include the applicable portions of question 10.4.1.1 and 2 above as it relates to the rupture of condensate lines and its effect on safety related systems to prevent safe shutdown of the reactor.
2. Paragraph 10.4.7.2 in the FSAR states amonia and hydrazine chemicals will be used for oxygen scavenging and PH control. Discuss the handling precautions that will be taken, the location where these chemicals are stored, the maximum inventory of each that will be kept at the site, and the precautionary methods taken to protect plant personnel against adverse effects from these chemicals should failures occur in the headers or connecting piping.