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WISCONSIN PUBLIC SERVICE CORPORATION

P.O. Box 1200, Green Bay, Wisconsin 54305

October 25, 1978

Division of Operating Reactors
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: Mr. A. Schwencer, Chief
Operating Reactor Branch #1

Gentlemen:

Docket 50-305
Operating License DPR-43
Response to Request for Additional Information on Fire Protection

Enclosed please find five (5) copies of the following documents:

Enclosure 1 - "Responses to Requests for Additional Information"

Enclosure 2 - "Analysis of Circulating Water Pump Oil Fire"

Enclosure 3 - "Analysis of Relay Room Fire"

This submittal is in response to your October 6, 1978, letter requesting additional information on Fire Protection at the Kewaunee Nuclear Power Plant.

Very truly yours,

E. W. James
Senior Vice President
Power Supply & Engineering

EWJ/cmn

Enclosures

7810300105

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ENCLOSURE 1

RESPONSES TO REQUESTS FOR ADDITIONAL INFORMATION

40. Provide the results of your evaluation of the adequacy of fire-rated barriers throughout the plant; indicate where upgrading of barriers is necessary. (3.1.2, 3.1.8, 3.1.26).

RESPONSE: Our first action was to delineate those floors, walls and ceilings that require a one or three hour fire barrier rating. This delineation was previously provided to the staff in our May 26, 1978, response to staff question No. 22. We then contracted an outside consultant to physically go over every designated barrier and record and sketch the dimensions, materials and construction of each penetration in the fire barrier.

We then compared this penetration data to data from fire stop tests performed by the Sacramento Municipal Utility District (SMUD) for the Rancho Seco Nuclear Generating Station. That report has been submitted to the NRC by SMUD and is available for review. The Rancho Seco fire stops tests were performed in accordance with ASTM E-119 with the exceptions noted in staff position No. 7 transmitted by your letter of March 13, 1978. The results of these comparisons indicated that four of the penetration designs used extensively at Kewaunee were not consistent with the designs tested for Ranch Seco. Consequently, approximately 225 out of about 250 electrical penetrations and approximately 90 out of 200 mechanical penetrations are being upgraded to meet or exceed those fire stop designs tested in the Rancho Seco report. The mechanical penetrations in the shield building wall contain hyperlon boot seals that are required for operation

40. <u>RESPONSE</u> (Cont.):

of the Shield Building Ventilation System, Kewaunee FSAR Section 5.5. No test data was available for this or similar material that was performed in accordance with ASTM E-119. A subsequent search for a sealant material for hot penetration piping showed that the hyperlon boot seals were the best available on the market. We have evaluted the manufacturer's data together with the relatively small penetration opening compared to the thickness of the concrete barrier and concluded that the fire barrier would remain intact for an equivalent one hour fire. Also, the vicinity of the pipe penetrations was reviewed and showed no combustibles located adjacent to the pipe penetrations. Due to the results of this evaluation and the FSAR safeguards requirements for the shield building wall penetration seals, no change will be made to those penetrations.

For the remainder of the penetrations that will be upgraded, a significant fire barrier already exists. Details of the existing penetration sealings were provided in our Fire Protection Program Analysis submittal, figure 5.4-1. These fire barriers will be upgraded by adding ½ inch Marinite XL board as a penetration barrier and filling the void space between the barriers with John Mansville Cera Fiber. Both the interior and exterior of the penetrations barrier will then be coated with Flamastic 71A. In addition, cable tray bottoms are covered with a 1 inch shunt of Marinite board extending through the penetration. This penetration design exceeds those tested at Rancho Seco in that the tested designs did not include the Cera Fiber fill or the shunt of Marinite board below the cable tray bottoms.

41. Provide the results of your evaluation of the separation of safe shutdown cables in conduit from redundant cables. Indicate where modifications will be required. (3.1.15)

<u>RESPONSE:</u> An investigation was made in all areas of the plant where safeguard cables passed, with the exception of the relay room and cable routing area from the relay room, to document the separation of trains between cable tray to cable tray, cable tray to conduit, and conduit to conduit of the two safeguard trains. The relay room and cable routing area were excluded because a loss of redundant cabling in these areas would be bounded by the analysis of the relay room fire in response to question 49.

Our evaluation revealed four areas where a hypothetical fire could affect both trains of safeguard cabling. These areas were examined in detail tracing the cables affected from equipment to source. The evaluation of these areas are discussed below.

The first area concerned many instances where heat tracing cables were in close proximity to the redundant train. Physical separation is an impossibility in the design of redundant heat tracing. However, a fire in the lower level of the Auxiliary Building where all the heat tracing cables are run would not affect the capability to put the plant in a safe shutdown condition. Alternate boron injection paths are available with ample separation between paths. Also, the RWST can be used to inject a high enough concentration of boric acid to ensure safe shutdown. No modifications are practical nor necessary to assure safety.

41. RESPONSE (Cont.):

The second area concerned several instances where control cabling of redundant equipment was involved. The loss of control of this redundant equipment was evaluated. Since the control function passes through relay room cabling, the loss of control of this specific equipment is less restrictive than a total loss of all relay room cabling. Hence, the analysis provided in response to question No. 49 bounds any analysis we would perform for the loss of any singular redundant components. No modifications are, therefore, planned.

The third area of concern was the redundant cables in conduit located in the diesel generator rooms. Specific evaluation of this area is contained in the response to question no. 47. No modifications are necessary.

The final area of concern is two specific locations where power cables in conduit pass in close proximity to cables in trays providing power to the redundant component. One situation concerns redundant Service Water isolation valves that isolate the Service Water supply to the turbine building. Preoperational tests of our Service Water system demonstrated that the Service Water supply during accident condition water demands by safeguard equipment is adequate even with the turbine building requirements on the system. Therefore, it is not an essential requirement that these valves isolate the turbine building supplies from the system. The second situation involves a power cable in conduit passing within three feet vertically of a power cable in a tray supplying redundant refueling water storage tank safety injection isolation valves. One of these valves is required to

41. RESPONSE (Cont.):

open during the injection phase of a loss of coolant accident. Loss of power to these valves during normal operation would have no effect on the operation of the plant or the ability to perform a safe shutdown. The extremely low fire loading in this area combined with the existing separation makes the loss of this redundant equipment not a credible event. Therefore, no modifications are warranted.

42. Identify the motor control centers for safety-related equipment which require protection from water spray and flooding caused by fire protection system failure or inadvertent actuation and describe the protection to be provided. (3.1.24)

RESPONSE: Our investigation revealed that there is only one motor control center for safety related equipment which will require protection from water spray or flooding from a fire protection system problem. This is the motor control in the material storage area, as discussed in the site visit. It will be protected by installation of a mastic coating over the equipment to protect it from water impingement.

43. Identify which fire doors protecting safe shutdown areas from large fire hazards or separating areas containing redundant safe shutdown cables or equipment will be electrically for fire protection. (3.1.25)

RESPONSE: The following doors will be electrically supervised:

Door No. 4
Door No. 6
New door between turbine building and Cardox room
Door No. 136

Door No. 9
Door No. 12

Door No. 47
Door No. 48
Door No. 49

Door No. 63

43. RESPONSE (Cont.):

Door No. 124
Door No. 117

Door No. 130
Door No. 180
Door No. 91

Door No. 123

Door No. 141
Door No. 143
Door No. 155

Door No. 156

44. Provide the results of your evaluation of the ability of service water hose lines in the reactor building to reach significant concentrations of combustibles in safety-related areas. (3.1.29)

RESPONSE: This inspection and evaluation will be performed at our next refueling outage. A sufficient supply of hose will be provided at that time if necessary.

45. Provide the results of your evaluation of the specifications and installation details for unlabeled fire door frames to demonstrate that the frames are equivalent to designs described in UL 63, "Standard for Safety of Fire Door Frames", Fifth Edition, November 19, 1976. (3.1.30)

RESPONSE: The fire door frame specifications and installation details have been reviewed and the door frames have been inspected to provide assurance that the frames are equivalent to or better than the designs described in the referenced UL document. Two types of door frames are used at Kewaunee and both door frame specifications and guage thicknesses meet or exceed the UL specifications. The only unconfirmed item was that of the exact location of the anchor. We physically inspected both types of door frames and found that one type of frame was used as a form for pouring the cement walls. For this frame the exact

45. RESPONSE (Cont.):

position of the anchors does not matter. The cement wall will prevent warpage of the door frame material ensuring fire protection integrity of the door. For the other type of door frame, we found that they were grouted in with cement with the exception of one door. The doors grouted in with cement will likewise prevent warpage of the door frame regardless of anchor position and ensure integrity of the fire boundary. The one door found not grouted in is the door to the 4160 switchgear room. The cabling and equipment in this room was examined and found not essential for safe shutdown of the plant. No further modifications or investigations are planned.

47. Identify the function of the redundant cables in conduit located in the diesel generator rooms. (5.11.3)

RESPONSE: The redundant cables in conduit located in the diesel generator rooms serve to indicate the status of possible voltage sources and other safeguard bus source. A loss of cable integrity will result in an indication of non-availability of off-site power source. If all sources or all source indication cables are lost, it will allow permissive for the startup and loading of the diesel generator.

48. Provide the results of your evaluation of the postulated causes and consequences of a circulating water pump lube oil fire. (5.15)

RESPONSE: The results of our evaluation of a circulating water pump lube oil fire are discussed in Enclosure 2 to this letter.

49. Provide the results of your evaluation of means for providing safe shutdown independent of cabling and equipment in the relay room. (4.10, 5.6.3)

49. RESPONSE: *The results of our evaluation for providing safe shutdown independent of the cabling and equipment in the relay room are discussed in Enclosure 3 to this letter.*

32. The fire barriers separating each diesel generator room from the corridor to the screenhouse are 1-1/2 hour fire rated due to the 1-1/2 hour fire doors and dampers in each barrier. These barriers serve to separate diesel generator oil hazards from redundant service water pump power cables located in the corridor. To provide adequate protection for the service water pump power cables from potential diesel generator room exposure fires, these barriers should be upgraded to a three-hour fire rating or a sprinkler system should be provided for the electrical cables in the screenhouse corridor.

RESPONSE: *We concur with your position. We will install a sprinkler system in the area immediately outside the diesel room doors in the screenhouse tunnel. We have agreed to provide this modification by January 1, 1980.*

ENCLOSURE 2

ANALYSIS OF CIRCULATING WATER PUMP OIL FIRE

Basis: The review and analysis of a possible oil fire was performed to show that the integrity of the Service Water pumps, which are required for operation and safe shutdown would be maintained. The NRC staff has presumed that an oil fire is possible resulting in the burning of the entire contents of the Circulating Water pump lube oil bearing housing (~45 gal). That assumed event according to the NRC staff position requires either an automatic sprinkler system for control of such a fire or an analysis showing the consequences of the fire are not detrimental to the integrity of the Service Water pumps.

I. This section explains the physical layout of the Screenhouse and the Circulating Water pumps. The results of this review will show that the oil fire postulated by the staff is physically impossible to attain.

A. A review of the Circulating Water Pump Motor shows that the lube oil is contained in the bearing housing located in the lower part of the motor structure surrounding the pump shaft. The only possible leak path would be a crack in this casing or a break of the fill/vent line. The leak would flow down the shaft or the motor/pump shroud structure into the torus of the pump. About 12" of the fill-vent line sticks out from the motor housing, so a possibility of a leak would exist outside the pump shroud. Examination of this possible event indicated that this leak would flow directly to the Screenhouse Sump.

B. The pump torus area is large enough to contain the entire contents of the oil housing. Upon examination it was found that the pump shaft seal controlled leakage is collected in this area. This flow which is allowed to leak from the impeller source area along the pump shaft is provided to cool the lower pump bearing. The flow is controlled at about 6 gallons per minute. The oil leak would mix with this water and would eventually be syphoned by a self-syphoning device into the Screen Room sump.

The syphoning device begins to syphon as the water level reaches the level of a plate covering the torus area. This volume was calculated to be about 102 gallons. Consequently, in a worst case situation the oil would have to be discharged fast and would be sitting in the torus area subject to ignition for only nine minutes before being syphoned to the sump. The plate over this area also would prevent ignition of the oil.

A failure of the self-syphoning device was considered. We have experienced breakdowns of this nature. An undetected failure would cause the level in the torus to rise to a point which would eventually overflow to the sump. A routine inspection is made twice a shift (every 4 hours) to ensure that the self-syphoning device is still working.

C. The structure of the Screenhouse is such that any overflow or leak would flow to the sump. Also, there is a continual flow to the sump from such sources as the service water pump bearing cooling water. The -flow into the sump is about 30 gallong/minute. So any oil leaks that eventually end up in the sump have a constant mixing with water. The sump contents are then pumped to the septic lagoons outside the site fence for settling before eventual discharge to the lake.

D. The staff postulated fire assumes that an oil leak can occur and go undetected for some period of time while an ignition source starts the fire. The only possible instance of this happening would require a massive rupture of the bearing housing and an immediate ignition from some unknown source. Massive ruptures of this type are not possible in unstressed metals. The oil is not under pressure. Secondly, a plausible ignition source has not been identified. The only suggested source by the staff is an overheated bearing. The pump bearing is water cooled and physically sits in water, and since a massive loss of oil would immediately stop the pump this ignition source is non-existent.

A slow leak due to a crack or poor fitting is a much more plausible situation. In this case, an already established bearing oil temperature alarm would warn the operators that something was wrong and an immediate investigation would take place. Therefore, the postulated worst case situation would never occur.

II. This section explains the oil burn test that we performed. The results indicate that potential ignition of the oil is very highly unlikely and the calculations performed in our previously documented response were conservative.

A. The Circulating Water Pump was physically examined and pump layout prints were used to determine as accurately as possible the equivalent area that would be exposed to a fire. It was determined that the worst case would be to have the lower torus area of the pump filled with water, due to a failed syphon system, up to the level of the plate. Then the oil would be assumed to collect on top of the plate.

1. Using a radius of 2.25 ft. yields a surface area of 15.89 ft^2

2. The area of the shaft was subtracted from this surface area

shaft radius = 0.625 ft
shaft area = 1.226 ft^2

3. Resulting in a donut shaped area of 14.66 ft^2

Note: The derivation of this calculated area and assumptions used were discussed with Paul Herman, NRC consultant.

B. A pan with 15 ft^2 surface area was used to perform the burn test. This is conservative in two aspects. First, the area is continuous and the heat more concentrated than in a donut shaped arrangement and would, therefore, yield more conservative, higher burn rates. Second, the torus area is completely enclosed by a shroud with two small screen areas on the side restricting the air needed for full burn, thus, the open burn would yield a more conservative, higher burn rate.

C. Approximately ½" of water was placed in the bottom of the pan to prevent possible destruction or warping of the pan to the extent that the contents of the pan would be spilled and the results of the experiment nullified. This would approximate the condition of the pump torus since water would be below the oil in any postulated circumstance. Furthermore, the results are even more conservative since no effort was made to simulate the six gallons/minute of water which would be flowing through the pump bearing seal into the oil.

D. Several methods of ignition were attempted and were unsuccessful. Matches, burning paper, and a burning oily rag were unsuccessful, indicating that conventional potential fire sources are not applicable. Finally, one quart of gasoline was used to heat the surface up to a high enough temperature for the oil to burn.

E. The following times were recorded after ignition was started:

Time	0 min.	-	gasoline on surface ignited
	1½ min.	-	gasoline assumed completely burnt and oil ignited
	5 min.	-	oil at full burn
	53 min.	-	the water at the bottom of the pan started to boil and the resulting steam dramatically began to extinguish the fire
	55 min.	-	the fire was extinguished and the oil was assumed to be completely burned, although oil-water mix was evident in bottom of pan

F. The size of the pan resulted in a 4.96" depth of oil in the pan.

Conservatively assuming a 48 minute burn, we can calculate a burn rate of 6.2 inches per hour. Accounting for the initial burn of oil and some oil left in the pan would result in a conservative estimate of 6.0 inches per hour burn rate.

III. This section is intended to re-evaluate the heat buildup in the screenhouse due to the staff postulated oil fire utilizing the exact dimensions of the pool and the burning rate determined during the oil burn experiment.

A. Dimensions and pump torus and pool previously calculated resulted in 15 ft^2 surface area with a depth of 4.96".

1. Total BTUs in oil = 6,600,000 BTUs

$$\frac{6{,}600{,}000\ \text{BTU}}{4.96\ \text{inches}} = 1{,}330{,}645\ \frac{\text{BTUs}}{\text{inch}}$$

$$\left[1{,}330{,}645\ \frac{\text{BTUs}}{\text{inch}}\right] \bullet \left[\frac{0.1\ \text{inch}}{\text{min.}}\right] = 133{,}064\ \frac{\text{BTUs}}{\text{min.}}$$

2. For a screenhouse volume of 176,314 ft^3 this would result in an air temperature rise per first minute of

$$\left[133{,}064\ \frac{\text{BTUs}}{\text{min.}}\right] \div \left[\frac{0.2399\ \text{BTU}}{\text{lb}\ ^{\circ}\text{F}}\right] \div \left[\frac{0.08\ \text{lb}}{\text{ft}^3}\right] \div \left[176{,}314\ \text{ft}^3\right] =$$

$\underline{\underline{39.32}}$ °F/first minute - assuming no heat transfer to structural components

B. As the temperature would rise to the 110°F, the Screenhouse fans would exhaust the atmosphere at a rate of 100,000 scfm. The results of this heat removal and the heat input would yield a temperature rise that would approach some maximum value when the BTUs discharged reached the BTUs input.

The calculation below establishes the air temperature in °F to exhaust the equivalent of the 133,064 BTUs/min input to the air.

1. The equation below establishes the Δ temperature rise above standard ambient temperature, 72°F, that would be equivalent to the same BTU input in the 100,000 scfm removed by the fans.

$$\left[\frac{\text{BTU}}{\text{min.}}\right]_{\text{in.}} \bullet \left[\frac{1}{\text{sp. ht air}}\right] \bullet \left[\frac{1}{\text{wt. of air}}\right] \bullet \left[\frac{\text{min.}}{\text{volume}}\right]_{\text{exhaust}} = \Delta\ ^{\circ}\text{F}$$

2. $$\left[\frac{133{,}064\ \text{BTU}}{\text{min.}}\right] \bullet \left[\frac{\text{lb}\ ^{\circ}\text{F}}{0.2399\ \text{BTU}}\right] \bullet \left[\frac{\text{ft}^3}{0.08\ \text{lbs}}\right] \bullet \left[\frac{\text{min.}}{100{,}000\ \text{ft}^3}\right] = 69.33\ ^{\circ}\text{F}$$

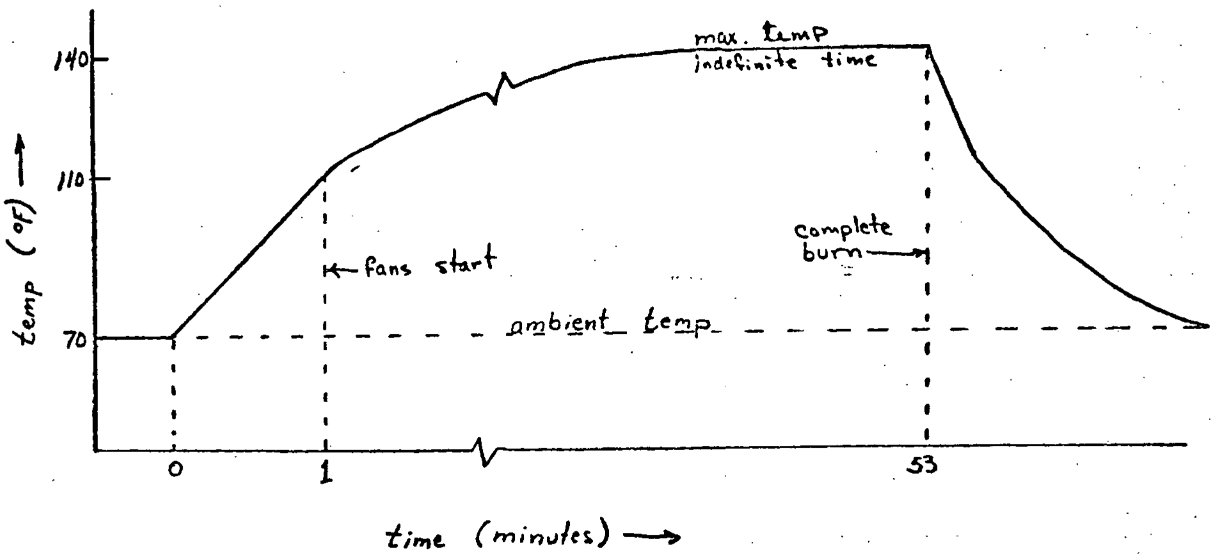
C. Balancing the equation in part A with the equation in part B would result in the following outcome:

1. - Heat input would be at such a rate as to raise the temperature of the room from ambient at a rate of 39.32°F.

2. The fans would come on when the rooms temperature increased to 110°F and would extract heat at a rate directly dependent upon the air temperature.

3. A balance would be reached when the heat exhausted equaled the heat input and the temperature would remain at that level.

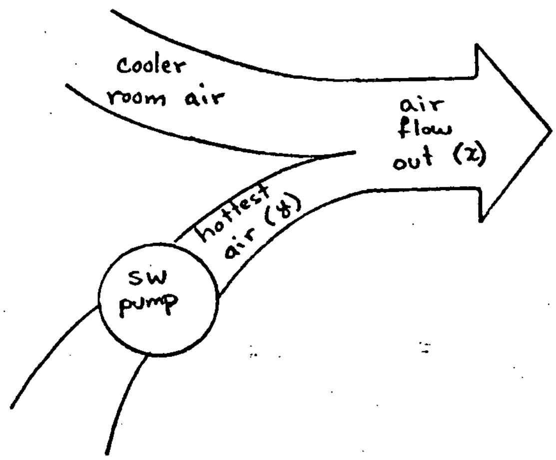
4. The temperature profile would look like the following:



5. Assuming an initial temperature of ~70°F in the room, the fans would start ~1 minute into room heatup. Maximum temperature would be reached in relatively short time, but would not exceed 140°F.

D. The calculation in part C does not account for streaming affects, it assumes uniform heat distribution for the total volume of the Screen-house. Since no streaming affect can be exactly calculated, the following is an attempt to show the sensitivity of various degrees of streaming.

1. The BTU input remains fixed at 133,064 BTUs/minute. The sensitivity of this calculation will only depend on the quantity and temperature of the air exhausted. The quantity remains fixed at 100,000 scfm but there is a temperature gradient of the air flows to the fan that may result in the Service Water Pump seeing a higher temperature. The graphics below is shown to illustrate this effect.



2. The only parameter that will affect the end result of this discussion is the ratio of the quantity of hot air (y) to total air flow out (x). Since both quantities should have the same relative heat capacity characteristics we could directly equate this ratio to temperature.

   Thus, the ratio $\frac{y}{x}$ is equal to the hottest temperature stream to the average temperature stream.

3. The above illustration is simplified. A more realistic view would show a diverse temperature gradient throughout the room being drawn toward the fans. We'll assume that the maximum temperature flow channel passes directly by the Service Water Pumps, and we'll also assume that maximum temperature channel to have a ratio to average gradient temperature of 2 to 1. This makes $\frac{y}{x} = 2$.

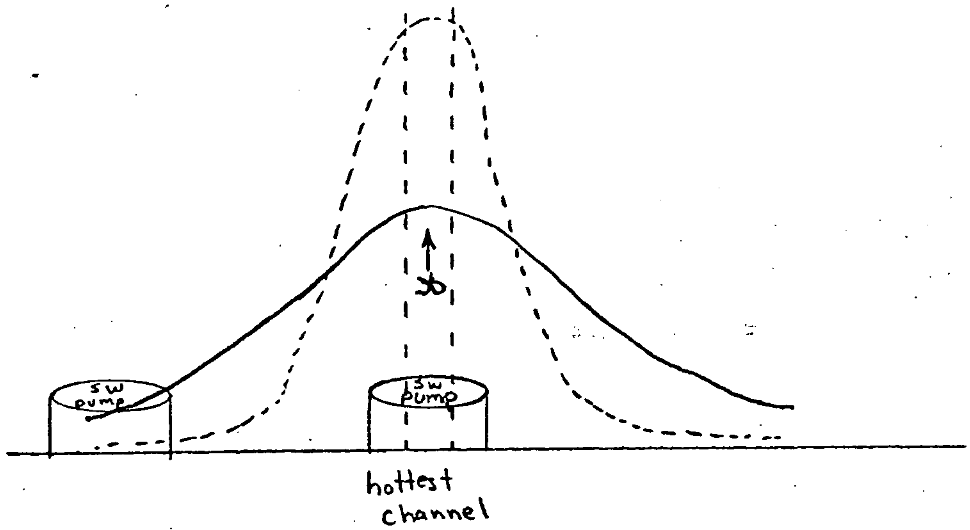
4. By direct comparison, we know that a heat balance will exist when the average temperature exhausted reaches 69.33^{o}F, thus

$$y = (2) \cdot (69.33^{o}F) \quad \text{or } 139.66^{o}F \text{ above ambient.}$$

5. Similarly, we can assume any quantity of streaming and calculate the maximum temperature the pump would see.

6. Our evaluation yields that the higher the ratio y/x the higher the temperature gradient and the more susceptible to damage the direct line in path pump will be, but conversely the neighboring pump will be that much more protected.

The following illustration shows the gradient affects of the flow path exiting toward the exhaust fans.



7. The result of this analysis shows that you can choose to make the air stream affects as hot as possible to take out one pump, but the higher you raise the factor y/x the less probable the adjacent pump will be affected.

The Service Water Pumps are guaranteed to operate under ambient temperatures of up to 110°C. For a short duration they could probably withstand much higher temperatures. With the physical layout of the screenhouse, the way it exists and the high temperature necessary to take out a pump, it is impossible to postulate the loss of more than one Service Water Pump.

IV. Summary

Besides all of the arguments presented defending the integrity of the Service Water System, the arguments themselves contain a good margin of conservation. The heat transfer analysis considered that the total heat generated was transferred into the air and none was absorbed by the structural components. If heat transfer by radiation would have been used in the analysis a large portion of the BTUs produced by the burning oil would have been absorbed by the structural components. Utilizing all the BTUs produced toward direct convection is a much more conservative approach as higher peak temperatures are reached. As mentioned, the burn rate was conservative because in a real situation the covers and shields would have limited the oxygen fanning the fire. And finally, there was no operator action or fire brigade response accounted for which is not realistic if the event actually occurred. Therefore, based on this analysis we cannot justify any further protection because it is not necessary or cost effective.

ENCLOSURE 3

ANALYSIS OF RELAY ROOM FIRE

Basis

The Kewaunee Plant relay room is a concrete structure containing low voltage control and instrumentation equipment mounted in steel enclosures interconnected with the remainder of the plant by electrical cables with equivalent qualification requirements in regards to fire protection to IEEE 383 cables. Other than relays and components enclosed in cabinets and the fire retardant electrical cables, the room has a negligible combustible loading. Both the control room and the interconnected relay room are subject to the limited access requirement of 10CFR73.55 such that unauthorized personnel or activities will not be present or performed within the relay room. Numerous fire detectors are located within the relay room to provide an alarm to the operating staff located in the control room in the extremely unlikely event of a fire within the relay room. The operators have at hand fire extinguishers for small fires and a full flooding CO_2 system which will provide a high concentration of CO_2 within all areas of the relay room within seconds, thereby, preventing the propagation of any fire. In summary, the relay room is vault-like structure without a credible mechanism to ignite the only combustible, IEEE 383 electrical cables, and is provided with an installed fire extinguishing system which meets NFPA Code requirements for deep-seated fires.

The NRC staff has not identified any credible mechanism by which a fire of greater magnitude than an individual component such as a relay or instrument could be initiated. Nevertheless, the position that all relay room cabling, instruments and relays are consumed in a fully enveloped fire within the relay room has been asserted by the NRC as a basic staff position. In addition, the NRC staff has proposed that safe shutdown instrumentation be required totally independent of the relay room or control room and that the minimum instrumentation should include pressurizer pressure and level and steam generator level.

In other incredible events such as loss of all cooling to a spent fuel pool or a LOCA licensees have presented analysis and/or evaluations which demonstrate that safety will be maintained and that no hazard exists to the health and safety of the public. The following demonstrates that even if the incredible event of total loss of the relay room were to occur, the Kewaunee Plant would be safely maintained in a shutdown condition indefinitely.

Evaluation

Initial Conditions: The plant is at 100% power with equilibrium Xenon. All control systems are in auto with water levels at programmed positions.

Event Sequence: A hypothetical fire is assumed to cause the loss of all instrumentation and control which is routed through the relay room. This includes:

a. Automatic safety injection signal

b. Steam dump control

c. Pressurizer pressure control

d. Pressurizer level control

Equipment located other than in the relay room is unaffected by the event. The following equipment will remain available upon the loss of the entire relay room:

a. All local instruments including local indication and transmitters associated with the relay room instrumentation racks.

b. The blackout signal and automatic sequence relaying. The relaying for this signal and sequence is in the diesel rooms and is powered from the respective station batteries.

c. All 4160V, 480V, and AC and DC vital bus protective relaying. The relays for these features are located in the individual buses and powered from the station batteries and the substation battery.

d. Circuit breaker local control for all 4160 and 480 volt switch gear.

Any fire related event requires some period to become fully developed and disabling to cables, instruments and relays. Due to the close proximity of the control room and the significant number of fire detectors within the relay room, the operators will have sufficient time to trip the reactor protection system before evacuation of the control room is necessary. Regardless of their action a trip signal will be generated by the fire due to the loss of equipment and both primary system letdown and secondary system blowdown will be automatically isolated. Additional remote tripping of the reactor is available.

A period of over one hour will exist following the reactor trip in which no additional action is necessary to provide for safety. The reactor trip assures sufficient reactivity insertion to maintain a subcritical condition of the reactor. The shutdown margin required by the Technical Specification is exceeded for twenty four hours following the reactor trip due to Xenon effects as long as rod insertion limits are met. The addition of Boric Acid during the first twenty four hours will provide for reactivity considerations associated with safety.

The normal pressurizer level is such that approximately 330 cubic feet of reactor coolant is within the pressurizer. Normal leakage through the reactor coolant pump seals is between 3 and 5 gpm each. Unaccounted leakage per the Technical Specifications is limited to 1 gpm. Total reactor coolant system leakage will, therefore, be less than 150 cubic feet/hour.

The normal steam generator water inventory is approximately 88,000 lbm per generator. The first hour decay heat load is estimated at approximately 92×10^6 BTUs, followed by a heat load of about 66×10^6 BTUs and 57×10^6 BTUs for the second and third hours respectively. The heat of vaporization at the secondary system safety valve setpoint is 640 BTU/lbm. The existing steam generator water inventory has 112×10^6BTUs of heat removal capability or more than one hour of steaming following a reactor trip without auxiliary feedwater addition. Reactor Coolant Pump heat and normal system heat loss were disregarded since their effect is second order in comparison to decay heat.

Manual starting of various pumps will permit the filling of the pressurizer and steam generators, thereby, assuring that the heat transfer path to the secondary system is maintained and that the secondary system will be able to liberate the heat be means of the secondary safety valves.

Addition of water to the reactor coolant system is accomplished by manually lining up one boric acid tank to a safety injection pump, starting the safety injection pump and pumping the contents of the boric acid tank into the reactor coolant system. The flow path from the safety injection pumps to the system is pre-aligned with the power breakers for the necessary motor operated valves locked open. Satisfactory pump operation is verified by observing pump suction pressure, pump discharge pressure and motor amperes at the breaker. The boric acid tank is verified to be discharging by observing safety injection pump suction pressure decreasing. At 15 psi the SI pump is stopped by the operators and the boric acid tank verified to be empty. Sufficient boric acid will have been added to assure cold shutdown reactivity considerations. The refueling water storage tank is lined up to the safety injection pumps. The pump is restarted and allowed to fill the reactor coolant system. Reactor coolant system pressure is maintained at the minimum flow head for the safety injection pump of 2211 psia. This pressure will prevent a steam bubble from forming in the core area as well as insure that the pressurizer is full. The safety injection pumps are centrifugal pumps and are not capable of overpressurizing the system. Pump damage is prevented by the orificed minimum flow recirculation line for the safety injection pumps. The thermal balance achieved by steam relief make a pressure increase due to an increase in temperature unlikely. In the event pressure does increase, due to a temperature increase, protection is afforded by the pressurizer safety valves.

The addition of feedwater to the steam generators can be accomplished by manually starting an auxiliary feedwater pump at the breaker and controlling feed flow at the pump local control station. Operation, in this case, is in accordance with an Emergency Procedure so auxiliary feedflow will be initiated within 30 minutes. Auxiliary feedflow will be set at 200 gpm using the local flow indicators and maintained at 200 gpm for the first three and half hours of flow. The water inventory at the end of this 3.5 hour 200 gpm auxiliary feedwater addition will be approximately 363,000 lbm in the steam generators which have a capacity for approximately 528,000 lbm. Following the 3.5 hour addition of auxiliary feedwater at 200 gpm the flow will be reduced to 75 gpm for the next 20 hours which will assure the existance of adequate water in the steam generator.

The above discussion assumes no information of level is provided to the operators for the first day. Nevertheless, the Kewaunee Plant has installed mechanical indications of steam generator level within containment for each generator, Those mechanical indicators are totally independent of the relay room. In addition, a mechanical indicator of pressurizer level is also within containment and only need be valved into the system to be functional at the hot shutdown condition discussed above. By dispatching an operator into the containment following the reactor trip to valve in the pressurizer level indicator and observe the local indicators, information as to specific levels in the various components is available.

The transmitters for levels associated with normal instrument channels would be functional if a power supply and signal level indicator were provided. The supplying of temporary power supplies and signal indication could be accomplished by the Instrumentation and Control personnel within one day. The calibration of the transmitters would not be affected by the removal of the normally associated equipment located in the relay room, therefore, with proper connection of temporary power supply and indication, an accurate indication of level would be available.

To accomplish a cooldown of the plant, only indicators of pressure are necessary since the steam tables provide correlation to temperature. The availability of level indicators for the pressurizer and steam generators will enable a normal cooldown to proceed. Manual alignment of components will be necessary such as opening of the RHR isolation valves at 350°F and manually starting the RHR pumps. Valves necessary for the cooldown of the plant are manually operable. Since boric acid was added as one of the first steps in the evolution, reactivity consideration of a cooldown will have been attended to.

As described above, upon the loss of the relay room an adequate heat sink can be provided without concern for specific water level for a period of one day. Sufficient highly concentrated boric acid can be added to the reactor coolant system followed by additional water from the refueling water storage tank to assure subcriticality and adequate reactor coolant inventory. Installed mechanical indications of pressurizer level and steam generator levels are available and existing electronic level indicators can be made operable within one day to aid in the cooldown evolution. Even considering the incredible event of a fully enveloped relay room fire sufficient equipment is available to assure safety and no justification exists for additional instrumentation separate from the relay room.