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

JAN 2 1981

Docket Nos: STN 50-454/455
STN 50-~~455~~ 456/457

Mr. J. S. Abel
Director of Nuclear Licensing
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P.O. Box 767
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Dear Mr. Abel:

Subject: Second Round Questions on the Byron and Braidwood OL Application

During our continuing review of your application for operating licenses for the Byron Station, Units 1 and 2, and the Braidwood Station, Units 1 and 2, we have identified a need for additional information which we require to complete our review. The specific requests contained in the enclosure to this letter are the first set of our round two questions and cover some of the areas of review performed by (1) the Auxiliary Systems Branch, and (2) the Structural Engineering Branch. Some items in the enclosure are statements of staff positions developed after reviewing responses to our first round questions.

Please contact us if you desire any discussion or clarification of the enclosed requests.

Sincerely,

Robert L. Tedesco, Assistant Director
for Licensing
Division of Licensing

Enclosure:
As stated

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010.0 Auxiliary Systems Branch

010.37 (3.4.1) (3.5.2) (9.2.1) (9.2.5) (Byron only) You have not provided an adequate response to Q010.26. Indicate how the Byron station essential service water system can be furnished adequate makeup water for long term plant cooling in the event of loss of function of the essential service water makeup pumps at the river screen house due to a probable maximum flood or tornado generated missiles. Indicate how onsite wells can perform this function when the accident is coupled with loss of offsite power and assuming a single failure. It is our position that adequate essential service water system makeup be assured in the event of a probable maximum flood or tornado missiles assuming a loss of offsite power and a single failure in accordance with the recommendations of Regulatory Guide 1.27.

010.38 (3.5.1.1) Your response to Q010.15 does not analyze or evaluate the protective features provided safety-related equipment assuming internal missiles are generated outside of containment by failures of equipment such as valves, instrument wells, pump impellers, drive couplings and fan blades. You state that protection is achieved by remote location or physical separation. Provide an analysis and an evaluation of how those protective measures are achieved for a typical safety-related system. The auxiliary feedwater system is considered a suitable example. The analysis should cover the entire system including the diesel and motor driven pumps, routing in the auxiliary building and pipe tunnel, junction with its respective tempering feedwater line, and termination at the primary containment. Equipment and pipe routing drawings should illustrate the protection afforded by

spacing and separation from adjacent high or moderate energy systems and potential missile sources listed above. The evaluation of this typical system should verify that no damage to safety-related equipment will result which would prevent use of the equipment necessary to reach a safe shutdown.

010.39 (3.5.2) Your response to Q010.2 and Q010.16 has not considered the effect of multiple missiles generated by one tornado on the various safety-related components located outdoors and on air intakes, exhausts and other building openings. It is our position that redundancy alone is insufficient assurance against the loss of safety-related functions in the event of missile impacts in a tornado and that specific design capability must be provided each component. Provide a description of the methods used to protect these structures, system and components from damage by multiple missiles generated by a tornado. Include the following:

Byron Station Only

Describe the protection provided to the essential service water cooling towers to prevent damage or loss of the fans or motor drives from the impact of multiple vertical tornado missiles falling into all the cell openings.

Byron/Braidwood Stations

a. Describe the protection provided to the exposed exhaust stacks of the station emergency diesel engines to prevent unacceptable damage or stack blockage from a single or multiple missiles impacting both stacks for one unit.

b. Describe the protection provided to prevent obstruction of flow of ventilating and combustion air to both emergency diesel engines of one unit from the impact of multiple missiles.

c. Describe the capability of the fuel handling building railroad freight door to withstand the forces of tornado wind and missile impact and the degree of protection or hazard presented by the wash down area structure. Consider the probabilities and potential adverse affects of lightweight objects of large area being impelled through an open, damaged or missing freight door into the spent fuel pool. Describe the administrative or other controls to assure closure of the freight door during normal plant operation.

Q10.40 (3.6.1) Provide a response to question Q010.17 and include the following in your response. Provide the results of analyses of the effects on safety-related systems of failures in any high or moderate energy piping system in accordance with the J. F. O'Leary letter of July 12, 1973, as defined in Branch Technical Position ASB 3-1, Appendix C. Provide a table which identifies the method of protection provided all safety-related systems listed in FSAR Table 3.6.1 from failures of any high or moderate energy systems listed in FSAR Table 3.6-2. Include figures depicting the locations of failures relative to the systems of FSAR Table 3.6-1 giving dimensions, locations and protective method for each postulated break or crack in a high or moderate energy system. Include the assumptions used in your analysis such as flowrates through postulated cracks, pump room areas, sump capacities, and floor drainage system capacities.

010.41 (3.6.1) Your response to question 010.4 is not complete. Discuss the worst case accidental environmental conditions of temperature, pressure, humidity, potential flooding consequences, and the duration of these effects which would result from an assumed crack, equivalent to the flow area of a single ended pipe rupture in the high energy lines located in the compartment between the containment and the safety valve house. It is our position that a break in these lines not impair the safe shutdown capability of the facility. Any equipment, which can be affected by the resulting environment including valve operators needed for safe shutdown, shall be qualified to withstand the worst case effects.

010.42 (9.1.3) You have postulated a failure of the spent fuel pool cooling system in section 9.1.3.1 of the FSAR and state that "it is anticipated that evaporative heat loss to the environment would limit the pool water to a 180°F maximum if all heat sinks and a nonadiabatic process is considered." Describe the steady state distribution of spent fuel decay heat losses to their ultimate heat sinks in this nonadiabatic process. Provide this information for both the design base case and the maximum stored fuel case. Describe the effects of the evaporative or steam losses from the pool surface in the fuel handling building environment, ventilation system and the handling of condensate from the hot pool within the fuel handling building.

In addition, describe the routing and ultimate residence of the makeup water used to prevent boiling after it leaves the spent fuel pool during the postulated loss of normal cooling.

During a seismic event, the non-Category I primary water makeup system and the fire protection centrifugal pumps could be lost coupled with a single failure in the common portion of the spent fuel pool cold water return line (OFC03B14, FSAR Fig. 9.1-8). Describe the method of cooling after the capacity of the refueling water storage tanks is exhausted, and the non-Category I backup makeup water sources are not available.

010.43 (9.1.4) Your response to Q010.7 is not complete. You have not provided a sufficient description of the precise methods, crane interlocks, administrative controls, structures, etc. to restrict the fuel handling building crane hook travel over the spent fuel pool. It is our position that administrative controls alone are an inadequate means to restrict movement to a particular position. Provide a description of the design used to prevent movement of the spent fuel cask laterally over the spent fuel pool while the fuel handling building crane bridge is positioned longitudinally to handle the spent fuel cask within the spent fuel cask storage area. Also provide this same information for movement of the fuel handling building crane hook when transferring new fuel to the new fuel elevator.

010.44 (9.2.2) Your response to Q010.9 is not complete. You have indicated that tests of the reactor coolant pumps performed by Westinghouse indicate that the pumps can function satisfactorily for 10 minutes without component cooling water supply. Low component cooling water flow alarms and high component cooling water temperature alarms from the reactor coolant pump oil coolers are provided in the control room to indicate a loss of component cooling water supply. Operator action can be taken within the

10 minutes available to secure the reactor coolant pumps. It is our position that the alarm indication of loss of component cooling water flow to the reactor coolant pumps be safety grade and meet the requirements for Class 1E instrumentation. Modify your response accordingly.

Q10.45 (9.2.4) Provide a piping and instrumentation diagram (P&ID) which shows that the potable and sanitary water systems do not interface with any system that might discharge radioactive materials and thereby contaminate the potable and sanitary water systems.

Q10.46 (9.2.5) (Byron only) Explain how the essential service water makeup pumps and the travelling trash screens shown in FSAR Figure 1.2-16 can accommodate a failure of the Oregon Dam downstream of the Byron Station concurrent with a low river discharge condition of the Rock River of 664 feet MSL. FSAR Figure 1.2-16 shows a basemat elevation of 664 feet without recesses or sumps for the pumps or screens. This figure is not consistent with the description in FSAR Section 9.2.5.3 where such provisions are described.

Q10.47 (9.3.3) Your response to Q010.30 has not provided an adequate analysis to demonstrate that drainage of leakage water away from safety-related components or systems is adequate for worst case flooding resulting from postulated pipe breaks or cracks in high or moderate energy piping near these safety-related components or systems. The analysis must show that drainage by natural routes such as stairwells or equipment hatches or by the non-seismic Category I drainage system under failed conditions is adequate to prevent the loss of function of safety-related components and systems. As an example, show that a crack in one essential service water line inside the essential service water pump room will not flood out the other redundant pump before operator action can

be taken to isolate the leak assuming a failed non-safety grade sump alarm system. Worst case locations should be assumed for this example and for other safety-related systems listed in FSAR Table 3.6-1.

It is our position that unless drainage capability by natural or by failed non-seismic Category I drainage systems can be demonstrated, you should provide the following for all areas housing redundant safety-related equipment.

1. Leak detection sumps shall be equipped with redundant safety grade alarms which annunciate in the control room. Verify that if operator action is required on receipt of the alarm that flooding of redundant safety grade equipment will not occur within 30 minutes; OR

2. Provide separate watertight rooms and independent drainage paths with leak detection sumps for each redundant safety-related component.

010.48 (9.4.6) (Byron only) Provide an analysis of the minimum temperature conditions which will be reached in the Byron river screen house following prolonged loss of the building unit heaters or loss of offsite power during extreme cold weather. Define the minimum operating temperature conditions at the essential service water makeup pump diesel drive units, the diesel oil supply system, and the essential service water lines as a function of time from heating system failure and of ambient temperature. State the reliability of starting the diesel drive units and of provisions to prevent freezing in stagnant water lines during the minimum temperature period.

010.49 (10.3.1) In Amendment 21, you revised your response to Q010.10 to delete your commitment to verify the operability of the air-operated atmospheric relief valves with no offsite power during low-power testing of the plant. It is our position that you recommit to perform this verification, or verify that the air-operated atmospheric relief valves can be opened remotely from the control room assuming loss of offsite power. Any backup air source for this purpose should be seismic Category I.

010.50 (10.4.5) Your response to Q010.33 concerning the effects of flooding resulting from a failure of the circulating water system transport barrier is incomplete. You have not provided an adequate response to items (4) & (5) of Q010.33. Our concern is for the consequences of a major circulating water system leak in the turbine building caused by failures of such non-seismic Category I components as the main water headers or expansion joints to the condenser coupled with failures of their corresponding butterfly isolation valves. The potential exists to flood the turbine building basement to the water level elevation of the cooling tower basin (Byron) or the cooling pond (Braidwood) by simple gravity draining from these large reservoirs.

Describe the designs and locations with the aid of drawings, if necessary, of the watertight barriers provided to prevent floodwater leakage from the turbine building to the auxiliary building or any other safety-related enclosure. Include a discussion of the consideration given to passageways, pipe chases and/or cableways joining the flooded space to spaces containing safety-related system components. As an example, discuss the means of preventing floodwater from entering the main steam tunnel and eventually reaching the auxiliary building at its termination with the main steam tunnel near the safety valve room. Include in the discussion water exiting the turbine

building at or above grade level and entering other safety-related enclosures through watertight barriers removed for maintenance.

010.51 (10.4.7) In Q010.13 we indicated that we were evaluating the preheat model steam generator (such as those utilized at the Byron/Braidwood Station) for hydraulic instabilities (water hammer phenomenon potential) and may impose further requirements. Based on these studies we have established the need for a verification test to demonstrate that no damaging water hammer will occur in the steam generator and/or feedwater system. It is our position that you commit to perform a test using the standard plant operating procedures to verify that unacceptable water hammer will not occur. We require that you provide us with a copy of the test procedure prior to performing the test.

010.52 (10.4.9) Your response to Questions Q10.14 and Q10.34 concerning our request for a reliability analysis for the auxiliary feedwater direct diesel driven pump is not acceptable. As indicated in NUREG-75/023 Supplement 1, dated August, 1975, we require that you provide us with evidence of the reliability of this pump to assure that its reliability is at least consistent with the reliability of the emergency diesel generators.

It is our position that the direct diesel drive system for the auxiliary feedwater pump meet those aspects of Regulatory Guide 1.9 "Selection, Design & Qualification of Diesel-Generator Units Used As Standby (Onsite) Electric Power Systems at Nuclear Power Plants," as are applicable to a diesel-pump unit. We recognize that Regulatory Guide 1.9 and its referenced IEEE Standards are designed for diesel-generator units but that many of its requirements can be adapted to a non-electrical output device. Clearly such

requirements as starting, load acceptance, vibration, overspeed, automatic control, and site testing are applicable to a diesel-pump unit as well as a diesel-generator unit.

Provide a comparison analysis of the reliability of similar features between the emergency diesel-generator and the auxiliary feedwater diesel driven pump. Include comparative reliabilities of the following subsystems: starting, combustion air, exhaust, flywheel, fuel oil, lubricating oil, cooling, governor, control, protection, surveillance, and cubicle environment. The comparative analysis shall be based on the applicant's or other's experience with similar equipment or subsystems. Where similarities between proposed existing equipment and subsystems are poor, the applicant shall justify his reliability assessment based on the specific differences between the subsystems. Test data comparisons of existing duplicate or nearest similar diesel drive arrangements should be included.

010.53 (10.4.9) Provide a response to our March 10, 1980 letter concerning your auxiliary feedwater system (AFS) design. This response should include the following:

1. A detailed point-by-point review of your AFS design against Standard Review Plan Section 10.4.9 and Branch Technical Position ASB 10-1.

2. A reliability evaluation similar to that performed for operating plants (refer to Enclosure 1 of the March 10, 1980 letter) and discussed in NUREG-0611.

3. A point-by-point review of your AFS design, technical specifications and operating procedures against the generic short term and long term requirements discussed in the March 10, 1980 letter.

4. An evaluation of the design basis for the AFS flow requirements and verification that your AFS will meet these requirements (refer to Enclosure 2 of the March 10, 1980 letter).

We note that your present AFS design provides two safety grade auxiliary feedwater pumps. We wish to point out to you that previous reliability studies for two pump auxiliary feedwater systems have indicated that installation of a third automatically started pump powered from a redundant emergency bus significantly improves AFS reliability. It is our position that you achieve a system reliability comparable to other recently approved operating Westinghouse plants with three safety grade auxiliary feedwater pumps.

130.0 Structural Engineering Branch

130.06 (3.7.2.1) Question 130.06

We have reviewed your response to Question 130.6 and we conclude that it is not adequate and not acceptable for the following reasons:

1) Selection of SSE and OBE Design Earthquakes

A considerable portion of your response is based on the conservatism you feel is in the SSE and OBE design earthquakes. You also presented arguments for reducing the design earthquake to those originally proposed in the PSAR (zero period acceleration of 0.06g for OBE and 0.12 for SSE).

These values have been subsequently increased to 0.09g and 0.2g respectively and rationale for the Regulatory staff position was stated in the Question 2.5.63. Furthermore, on the basis of further investigation the staff came to the conclusion that the deconvolution procedures are not acceptable and that the Regulatory Guide 1.60 Design Response Spectra should be applied at the foundation level.

2) Effect of Foundation Size on Design Spectra

The response suggests that the design spectra can be reduced based on previous studies performed by Dr. Newmark for the Diablo Canyon Site. These studies justify reduced effective spectra as a result of considering the effect of foundation size on design spectrum. You pointed out in the response that the reduced effective spectra were developed for the specific site of the Diablo Canyon Plant and the basic reason for its acceptance

was the postulated near-field earthquake. Since the Byron/Braidwood sites are located in an entirely different tectonic province the argument which was used in case of Diablo Canyon application cannot be applied to the subject sites.

3) Conservatism in Analysis

The staff does agree that the three components of earthquake motion are probably not the same acceleration. The magnitude of the actual acceleration of each component should be found by means of a 3-dimensional analysis. It is the position of the staff that the response spectrum for vertical motion can be taken as 2/3 of the response spectrum for horizontal motion for the Western United States only. For other locations, the vertical response spectrum should be the same as that given in Regulatory Guide 1.60. (See Enclosure)

As far as the damping values are concerned, the referenced report, NUREG-CR 0098 was developed for a specific purpose of evaluating seismic risk of nuclear plants which are already operating. The damping values contained in that report cannot be applied in licensing of new plants.

The response claims that the elastic analysis which is used in design of new plants may be unreasonably conservative. In view of the fact that there is a lot of safety-related equipment which might produce catastrophic consequences in case of excessive deformation of supporting members, this position of the Regulatory staff is not unreasonable. You neglected to mention in your response that the referenced criteria for the Diablo Canyon plant stipulate that the ductility of 1.3 for concrete and 3 for steel are

for turbine building and intake structure. These structures are non-Category I per se and the only reason that they have been reviewed by the staff was that in certain locations they are housing some safety-related equipment. Thus the criteria which are applicable to these two structures cannot be automatically applied to all Category I structures.

4) Evaluation of Structures using 0.09g OBE and 0.20g SSE Regulatory Guide 1.60 Spectrum

The evaluation of structures using the Regulatory criteria provided in the response have been reviewed. It is recognized that there is a general increase in the stress level of many structural members. We find, however, that without re-analysis of the affected structures and determination of the shear forces and moments imposed by the new loads the evaluation cannot be considered to be conclusive. You are, therefore, requested to compare the structural responses of Category I structures and the design parameters (bending moments, shears and axial loads) actually used in design of Byron/Braidwood plant with those which would have been obtained if the criteria stated in Question 130.06 were used.

130.9 (3.7.2.4) For the river screen house at the Byron station there is a marked increase in the response spectra for most of the frequencies of interest in structural design. The technical position of the Regulatory staff is that the results of the two methods, i.e., the half space and the finite element method should be enveloped in order to be used in the design. This position is stated in the Enclosure and designated as Method 3(a). As an alternate solution, the staff would find acceptable the two other options which are designated in the Enclosure as Methods 3(b) and 3(c). You are requested to perform a seismic analysis using one of the above noted three options, quantitatively assess its impact on structural design of the river screen house at the Byron plant and submit the results for our review.

ENCLOSURE

SUMMARY OF SEB INTERIM LICENSING
POSITIONS AND STATUS OF SRP REVISION
MARCH 1979

SRP SECTION	INTERIM LICENSING POSITION IN ADDITION TO OR DIFF. FROM THOSE LISTED IN CORRESPONDING SRP SECTIONS
3.7.1 Seismic Input	1. Use of site dependent input design spectra is acceptable if the input spectra are reviewed and accepted by GSB (Ref. SRP Section 2.5) 2. For western United States (West of Rockies), the response spectrum for vertical motion can be taken as 2/3 the response spectrum for horizontal motion over the entire range of frequencies. 3. Methods for implementing the soil-structure interaction analysis should include both the half space lumped spring and mass representation and the finite element approaches. Category I structures, systems and components should be designed to responses obtained by any one of the following methods: a) Envelope of results of the two methods, b) Results of one method with conservative design consideration of impact from use of the other method, c) Combination of (a) and (b) with provision of adequate conservatism in design. 4. Consideration of the effects due to accidental torsional forces in design (as a minimum, the 5% times base dimension off-setting criteria should apply).