Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

December 19, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Generating Station Units 1 and 2
Braidwood Generating Station Units 1 and 2
Charging Pump Deadheading
NRC Docket Nos. 50-454, 50-455, 50-456, and 50-457

References (a): September 9, 1982 letter from F. G. Lentine to H. R. Denton.

(b): September 16, 1983 letter from T. R. Tramm to H. R. Denton.

Dear Mr. Denton:

This is to provide additional information regarding the changes being made at Byron and Braidwood stations to assure that minimum flow will be maintained during design basis transients. This information addresses questions posed by NRC Staff in the review of references (a) and (b). NRC review of this information should enable closure of Confirmatory Issue 16 in the Byron SER.

Reference (b) described the interim operation configuration for Byron 1. The attachment to this letter addresses the consequences of postulated single failures in this configuration. Appropriate changes are being made to the Byron operating procedures to provide for prompt manual isolation of a charging pump miniflow line in the event of a valve failure during the ECCS recirculation mode.

Please address further questions regarding this matter to this office.

One signed original and fifteen copies of this letter and the attachment are provided for NRC review.

Very truly yours,

F. G. Lentine
for T. R. Tramm
Nuclear Licensing Administrator

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Attachment

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Attachment

The following is provided in response to questions raised by Walt Jensen of the Nuclear Regulatory Commission on the subject of the interim miniflow protection system for the centrifugal charging pumps at Byron Unit 1. In the intended final design, the individual recirculation line of each centrifugal charging pump will contain the following components: a check valve (8480 A/B), a 60 gpm flow limiting orifice, a normally open solenoid isolation valve (8114, 8116) automatically opened or closed by Reactor Coolant System pressure in the presence of a safety injection signal, a motor operated isolation valve (8110, 8111) automatically closed by low water level in the Refueling Water Storage Tank in the presence of an "S"-signal, and a manual isolation valve (8479 A/B). The individual miniflow lines from each centrifugal charging pump join to form a common line which passes through the seal water return heat exchanger and returns to the charging pump suction header. The system design pressure changes from 2485 psig to 150 psig in the common portion of the recirculation line upstream of the seal water return heat exchanger.

Due to equipment availability and delivery considerations, the automatically controlled solenoid isolation valves (8114, 8116) will not be installed prior to fuel load. This has given rise to questions concerning the consequences of single failures during this interim period. The specific situation of interest concerns the failure of motor operated valve 8110 or 8111 to close and the effect of these failures on the low pressure portion of the pump miniflow line when the charging pump suction is supplied by the RHR pump discharge during the post-accident recirculation from the containment sump. For small and intermediate size LOCA, the RHR pumps would be run back on their performance (curves). If either 8110 or 8111 in the charging pump miniflow line were open under these circumstances for the interim system configuration, the pressure in the low pressure portion of the charging pump recirculation line could be elevated to the 150 psig set pressure of relief valve 8123 upstream of the seal water return heat exchanger. If the charging pump is running at this time, approximately 60 gpm of the pump flow would be discharged through relief valve 8123 into the safety class 2, seismic category 1 Volume Control Tank. If the charging pump was not running, the relieved flow would be approximately 10 gpm. The Volume Control Tank is a 400 ft^3 tank with normal water level ranging from 20% to 40% of level instrument span with an overpressure of 20 psig. Assuming the tank was full at an initial pressure of 30 psig, a liquid inflow of 120 ft^3 (898 gallons) would raise the gas blanket pressure to the 75 psig set pressure of the VCT relief valve 8120. If the inflow to the VCT was not terminated, the Volume Control Tank relief valve 8120 would in turn relieve to two safety class 3, seismic category 1, recycle holdup tanks at 100,000 gallons each. Normal holdup tank level is less than 50% full providing an available holdup capacity of 100,000 gallons total. These tanks in turn overflow to the auxiliary building sump.

It is obviously undesirable to permit contaminated sump water to propagate throughout various areas of the auxiliary building. Interim plant operating procedures will therefore instruct the operator to verify that the RWST level controlled motor isolation valve 8110/8111 in each charging pump miniflow line has closed. Such verification will be completed following the ECCS switchover from the RWST to the containment sump.

Failure of either valve to close will be indicated on the control board by the valve position status lights and by the monitor light panel. Relief valve discharge into the Volume Control Tank will be indicated by high or increasing VCT water level (level instruments LT-112 and 115) and by high or increasing VCT pressure (pressure instrument PT-115). Relief valve discharge from the Volume Control Tank into the recycle holdup tanks is indicated by level instruments LT-260A and LT-260B.

Upon determining that motor operated isolation valve 8110/8111 is not closed, the associated centrifugal charging pump would be stopped to reduce the rate of discharge into the Volume Control Tank (provided of course that the other centrifugal charging pump is running). An operator would then be dispatched to close local manual isolation valve 8479 A or B. Alternatively, motor operated isolation valve 8110 or 8111 could be closed locally using the valve handwheel.

Application of the time response criteria in ANS 58.8, Revision 2, March 1981 indicates that the most limiting event in terms of the time available for operator action would be a large loss-of-coolant accident. The suction of the RHR pumps could be switched to the sump and the charging pump miniflow isolation valves 8110/8111 could be closed on low-low RWST level as early as 12.5 minutes after an "S"-signal for a large LOCA. The charging pump suction would be switched to the RHR pump discharge 3.9 minutes later at 16.4 minutes. At this time, the discharge of sump fluid into the VCT could begin at a rate of 60 gpm. ECCS switchover from the control room would be completed approximately 2 minutes later at 18.4 minutes. ANS 58.8 recommends an operator action time delay (tm-te) of 20 minutes for condition IV events. It is at this time (20 minutes after event initiation) that the open isolation valve 8110 or 8111 would be detected.

For operator actions in the control room, ANS 58.8 recommends for condition IV events a time response of (5 + N x 1) minutes where "N" is the number of discrete actions. Six minutes later at 26 minutes, the charging pump associated with the open miniflow isolation valve would be stopped, reducing the discharge rate into the VCT from 60 gpm to 10 gpm. An operator would also be dispatched to the charging pump cubicle to close the manual isolation valve 8479 A or B at this time.

At this point, a maximum of 576 gallons of sump water could have been discharged into the VCT [i.e., (26 min-16.4 min) x 60 gpm]. Assuming that the VCT was initially half-full at 30 psig pressure, the VCT could accept as much as 320 additional gallons before the VCT gas pressure would reach the 75 psig set point of VCT relief valve 8120. With an inflow rate of 10 gpm after stopping the charging pump, an additional 32 minutes would be available for an operator to reach the charging pump cubicle and close manual isolation valve 8479 A or B. ANS 58.8 provides no specific recommendations for operator action outside the control room except that it should be "appropriate". It seems altogether reasonable for a trained operator to reach a familiar location in the auxiliary building (charging pump cubicle) and close a single 2" manual valve in 32 minutes. The consequences of taking a longer period of time to complete the requird action, while undesirable, are certainly not catastrophic because of the large capacity of the recycle holdup tanks.