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

September 27, 1984

Mr. James G. Keppler
Regional Administrator
U.S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Byron and Braidwood Stations Units 2 and 3
Response to IE Bulletin 84-03
NRC Docket Nos. 50-454/455 and 50-456/457

Reference (a): IE Bulletin 84-03 - R. C. DeYoung letter to All OLs and CPs dated August 24, 1984

Dear Mr. Keppler:

Reference (a) requested us to evaluate the potential for and consequences of a refueling cavity water seal failure prior to beginning refueling. Attached is the response for Byron and Braidwood Stations.

To the best of my knowledge and belief the statements contained in the Attachment are true and correct. In some respects these statements are not based on my personal knowledge but upon information furnished by other Commonwealth Edison employees, contractor employees and consultants. Such information has been reviewed in accordance with Company practice and I believe it to be reliable.

Please address any questions that you or your staff may have concerning our response to this office.

IE11
/1

One (1) signed original with Attachment is being sent directly to the USNRC Document Control Desk in Washington, DC for reproduction and distribution as requested in the Bulletin.

Respectfully,

G. L. Alexander

G. L. Alexander
Nuclear Licensing Administrator

Attachment

cc: US NRC, Document Control Desk
Washington, DC 20555

RIII Inspector - BY/BW

SUBSCRIBED and SWORN to
before me this 27th day
of September, 1984

Rosalie A. Puenta
Notary Public

9245N

ATTACHMENT 1

RESPONSE TO IE BULLETIN 84-03
REFUELING CAVITY WATER SEAL

BYRON AND BRAIDWOOD STATIONS

Evaluation of Byron/Braidwood Refueling Cavity Water Seal

Summary and Conclusions

Important design differences between the Byron/Braidwood refueling cavity seal and the Haddam Neck seal make a loss-of-seal integrity event at Byron/Braidwood significantly less likely to occur. Discussions with the seal supplier and the Haddam Neck staff indicate the cause of the seal failure to be misalignment and/or overinflation of the seal bladder, or improper design tolerances. Based upon these discussions and the evidence to date, it is our opinion that overinflation of the seal to the pressure reported at Haddam Neck without a corresponding misalignment or out-of-tolerance problem with the seal would not cause a seal failure at Byron/Braidwood. Since the Byron/Braidwood design does not require alignment of any sort, we conclude that occurence of this event at Byron/Braidwood remains very unlikely.

Although very unlikely to occur, this event has potentially serious consequences. Therefore we are adding precautions to the station fuel handling procedures to ensure that the seal is inflated to an acceptable pressure range. The seal dimensions and the reactor vessel/refueling cavity floor gap tolerances will be checked against design values, and the design will be reviewed with the supplier. Unless further information from the Haddam Neck event warrants it, neither we nor the seal supplier are recommending any design changes to the Byron/Braidwood seal at this time.

Evaluation

Seal Design

The Byron/Braidwood refueling cavity seal consists of a single split-joint type PRS 585 inflatable rubber ring supplied by the Presway Corporation. Figure 1 shows a cross section of the Byron/Braidwood seal. Figure 2 shows a cross section of the Haddam Neck seal arrangement. The major difference between the two designs is the steel ring in the HN seal which requires that two inflatable rubber seals be in place on either side of the ring. The ring is about one foot wide with a two inch gap on each side of it. The ring is supported by nine hangers (strongbacks) arranged around the reactor vessel flange. It is reported that this ring can be displaced horizontally, (there is no alignment fixture for the seal ring) thus changing the width of the gaps on each side of the ring. It is believed by Presway that this actually happened and contributed to failure of the seal. The Byron/Braidwood seal consists of a single rubber seal, similar to one of the Haddam Neck seals, but with a fixed, unadjustable gap width. The problem of misalignment therefore does not exist at Byron/Braidwood.

Other important differences between the Byron/Braidwood seal and the Haddam Neck seal are summarized in Table 1.

Table 1

Byron/Braidwood vs. Haddam Neck Refueling Cavity Seal Design

Design Feature	Byron/Braidwood	Haddam Neck
Supplier	Presway Corp.	Presway Corp.
Seal top width	4 inches	3 1/2 inches
Overall seal height	6 1/2 inches	5 1/2 inches
Gas width (1)	1 13/16 inches	2 inches (each gap)
Seal top hardness(2)	60	40
Inflation pressure(2)	30-35 psig	30-35 psig

(1) There are two gaps in the Haddam Neck seal arrangement a shown in Figure 2.

(2) The durometer readings of the seal top are 60 and 40 for the Byron/Braidwood and Haddam Neck seals respectively.

(3) The Haddam Neck seal was reportedly inflated to about 40 psig at the time of failure.

These dimensions are all in the conservative direction against failure of the Byron/Braidwood designs in the event of overinflation. Overinflation of the seal is thought to cause failure by causing the seal top to buckle downward. This effect combined with the water pressure from the filled cavity forces the seal through the cavity floor gap. The Byron/Braidwood seal top is made of harder rubber and is wider than the Haddam Neck design and therefore less susceptable to buckling. Also, the gaps at Byron/Braidwood are narrower than the Haddam Neck gaps, and more importantly, not adjustable.

Emergency Procedures

Emergency procedures exist at Byron for a level loss in both the refueling cavity and the spent fuel pool, references 3 and 4. The procedures require that on receipt of indications of level loss, which includes level indication in the control room, that fuel in transit or in the RCCA change fixtures be inserted in the reactor vessel or the spent fuel pool, whichever action takes the least amount of time. Isolation of the spent fuel pool from the refueling cavity is then performed by closing the sluice gate and the transfer gate valve. This sequence of actions will minimize the level decrease rate since the two pools are connected until the fuel is in safe locations. Makeup water can then be supplied to the reactor cavity from the RH System or the FC system if necessary. There are three sources of makeup water available to the spent fuel pool including a borated Safety Category I source, a Category I unborated fire protection source, and a non-Category I unborated water source. Either of the three sources can be used for pool cooling while maintaining a keff of less than 0.95, (Ref. 6). The spent fuel pool could be filled at a rate of about 4 inches per minute if necessary, with a total time of just over one hour to fill it from the top of the active fuel to normal level, using the fire protection system.

Seal Failures

Loss of Air

The air supply to the refueling cavity seal at Byron/Braidwood consists of a dedicated nitrogen supply so that loss of one of the station air supplies will not affect the seal. If the air supply is lost, no leakage is expected because the air is essentially a redundant sealing mechanism to the water pressure from the filled reactor cavity. If leakage does occur in this event is would be well within makeup capacities and more than adequate time would be available to return irradiated fuel asemblies to a safe location.

Gross Seal Failure

Because the seal is installed and the refueling cavity is filled long before irradiated fuel is actually moved (on the order of days), any serious problem with the seal is expected to occur before the potential for damaging fuel exists. This was the case at Haddam Neck.

If a gross seal failure did occur during fuel movement, from an unspecified cause that was on the order of the Haddam Neck event, we do not expect to sustain any fuel damage. The probable sequence of events is as follows. A leak on the order of 10,000 gpm occurs which begins to drain the refueling cavity/SFP system at the rate of about 5 inches per minute. Refueling procedures would allow a maximum of three fuel assemblies out of storage locations in the reactor vessel and the SFP at any one time. There could be two assemblies in the RCCA change fixture, and one in the tilt machine. The top of the active fuel in the RCCA change fixture is approximately one foot above the reactor vessel flange. Given this leakage rate it would conservatively take 50 minutes to reach a level 2 ft. above the top of the fuel. This is more than adequate time to return the three assemblies to safe locations in the reactor vessel and the SFP, even if no action were taken to begin supplying makeup water to the pool.

If the fuel for some reason was not removed from the RCCA change fixture, and no action was taken to isolate the SFP and supply makeup water, the water level would reach its minimum level about 1 hour after initiating the event. At this point the SFP would have water over the top of the active fuel, and about 1 foot of the fuel in the change fixtures would be uncovered. This assumes that the incore instrument shaft cover fails and the refueling cavity water flows to the recirculation sump. If the cover did not fail, the cavity level would only drop about 3 1/2 feet, so that the fuel would remain under 19 feet of water. If the cover fails the RHR pumps would be put on line (one would already be running for shut down cooling flow) to recirculate water from the sump to the reactor cavity at a maximum rate of 10,000 gpm. In this case, the two assemblies in the change fixture would receive adequate cooling.

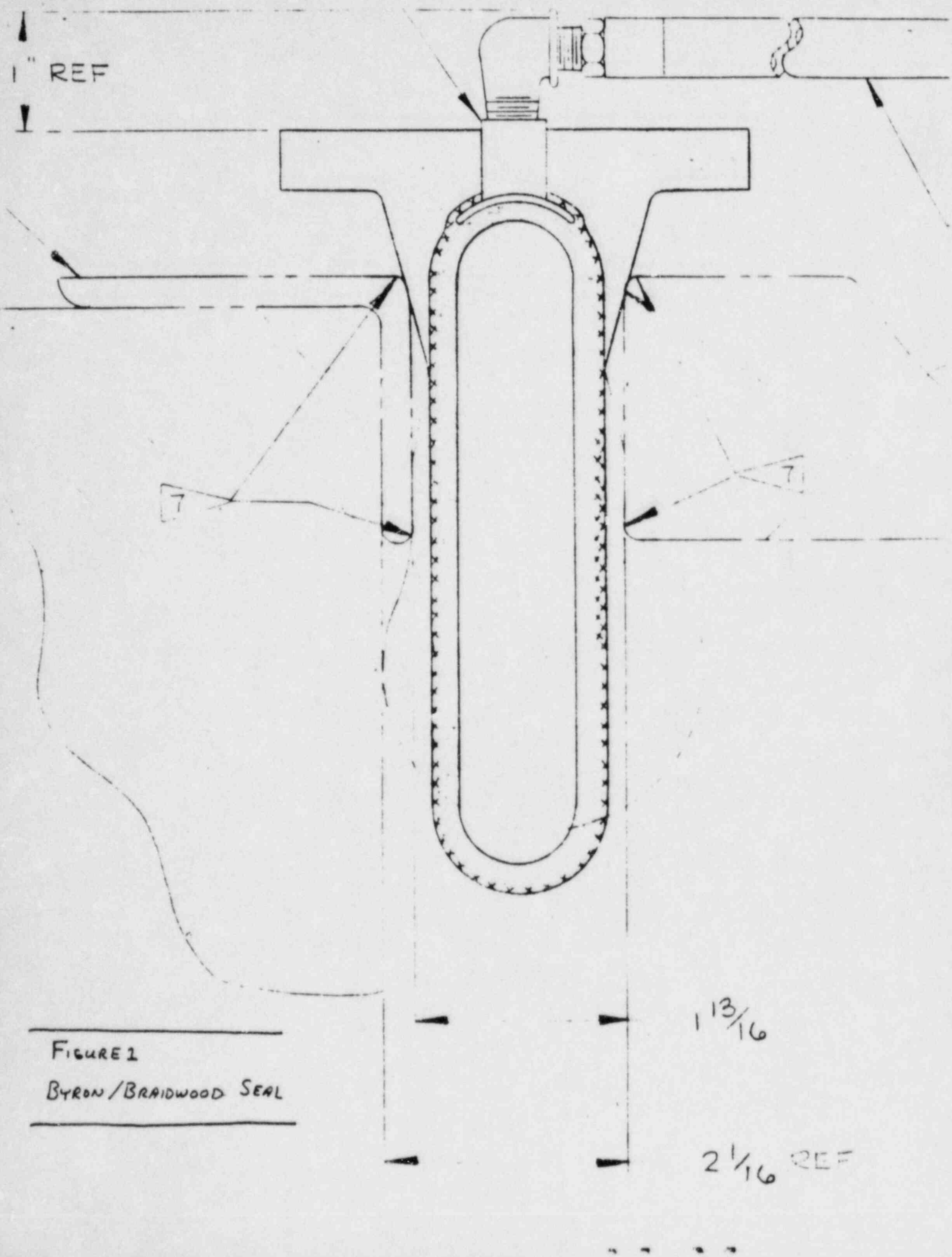

Figure 1
Byron/Braidwood Seal

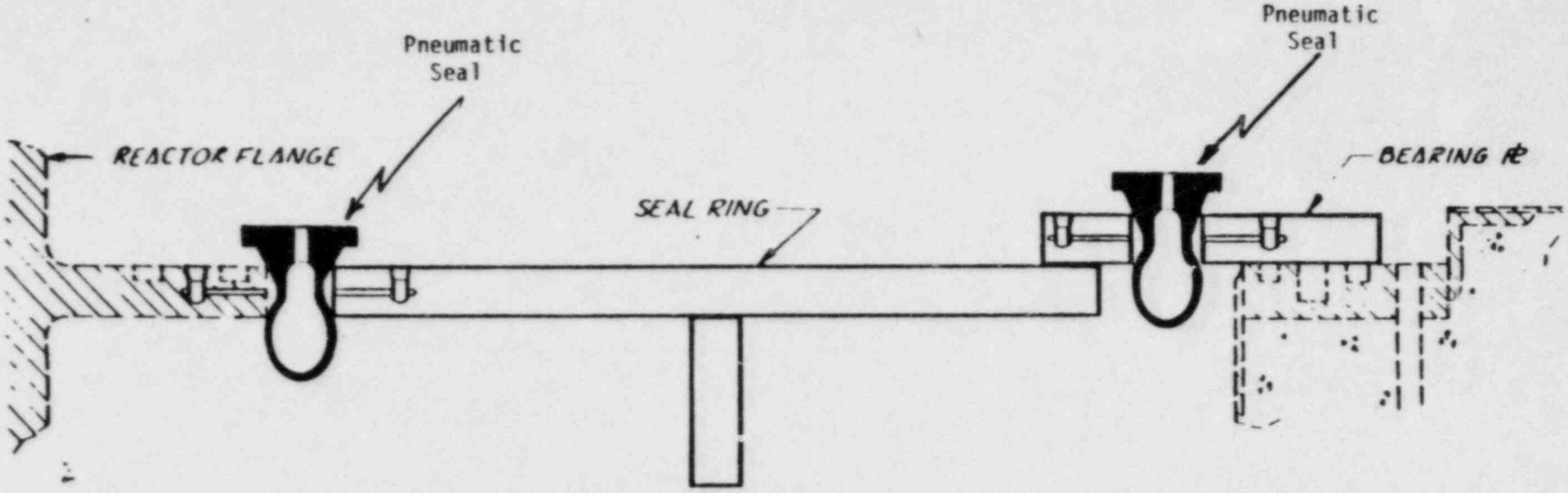

Figure 2 - Haddam Neck Refueling Cavity Water Seal

<u>References</u>

1. Telephone conversation between Ted Hollander of Presway Corp. and K.D. Brienzo of CECo on 9-14-84 concerning refueling cavity seal design details and the Haddam Neck event.

2. Telephone conversation between Dan Casey of the Haddam Neck staff and K.D. Brienzo of CECo on 9-12-84 concerning the seal failure incident of August 21, 1984 and probable causes.

3. Byron procedure number 0BOA REFUEL-3, Rev. 1, SPENT FUEL POOL LEVEL LOSS UNIT 0.

4. Byron procedure number 1BOA REFUEL-2, Rev. 1, REACTOR CAVITY LEVEL LOSS UNIT 1.

5. Discussion between Andy Mills of Byron Fuel Handling Staff and K.D. Brienzo of PED at Byron on 9-13-84.

6. Byron/Braidwood FSAR Section 9.1.3 and 9.1.4, available makeup to the refueling water cavity and the spent fuel pool.

7. Fire Protection Report Section 2.1.3.2.3, operation of the fire protection system.

8. Letter to D.M. Crutchfield from Connecticut Yankee Atomic Power Co. dated August 31, 1984, Docket No. 50-213 B11 299.