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MURRAY R. EDELMAN
VICE PRESIDENT
NUCLEAR

November 27, 1984
PY-CEI/OIE-0019 L

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

Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
IE Bulletin 84-03
Refueling Cavity Water Seal

Dear Mr. Keppler:

In accordance with the request in I.E. Bulletin 84-03, "Refueling Cavity Water Seal," the attached summary report is provided to address the potential for, and consequences of, a refueling cavity water seal failure.

The evaluation includes consideration of each of the items noted in the Bulletin, and concludes that this is not a concern at the Perry Nuclear Power Plant (PNPP) due to the type of cavity water seal utilized in the design of PNPP.

Very truly yours,

Murray R. Edelman
Vice President
Nuclear Group

MRE:njc

Attachment

cc: Jay Silberg, Esq.
John Stefano
J. Grobe

U.S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Washington, DC 20555

U.S. Nuclear Regulatory Commission
c/o Document Control Desk
Washington, DC 20555

IE11

Summary Report on Refueling Cavity Water Seal Failure In Response to I.E. Bulletin 84-03

This summary report addresses each of the items noted in the I.E. Bulletin 84-03, which requests evaluation of the potential for, and consequences of, failure of the refueling cavity water seals. The evaluation considers (1) gross seal failure (2) maximum leak rate due to failure of active components such as inflated seals (3) make-up capacity (4) time to cladding damage without operator action (5) potential effect on stored fuel and fuel in transfer and (6) emergency operating procedures.

(1). Gross Seal Failure

The design of Perry Nuclear Power Plant (PNPP) does not utilize pneumatic seals for the refueling cavity water seal, but rather uses a metal bellows design manufactured by Pathway Bellows Co. All connections are welded. The metal bellows provide a flexible watertight seal between the reactor pressure vessel and the drywell structure. The design includes a self-energizing stainless steel spring which functions as a secondary seal to limit water loss following a rupture in the main bellows element. A half coupling is provided on the backing plate for monitoring leakage. Figure 1 illustrates the seal design.

The leak rate would be very small in case of a gross failure of the primary bellows element because of the secondary seal.

(2). Maximum Leakage Rate Due To Failures Of Active Components Such As Inflated Seals.

The design at PNPP does not incorporate any active components. Leakage would be very small as indicated in (1) above.

(3). Makeup Capacity

Makeup to the upper pools is provided by the Fuel Pool Cooling and Cleanup system (G41). Normal makeup is 300 gallons per minute (gpm). Maximum makeup of 3000 gpm from the Fuel Pool Cooling and Cleanup System is available by aligning all flow to the upper pools.

(4). Time To Cladding Damage Without Operator Action.

If bellows failure occurs during operation of the reactor, there would be no loss of the primary coolant since there is no communication between the sealed primary coolant system and the upper containment pools. Thus there is no possibility of cladding damage to fuel residing in the reactor core. In fact, bellows failure will result in no loss of water at all if the drywell head seal is effective. See Figure No. 2.

If bellows failure occurs during refueling, with the gate between the reactor well and the steam dryer pool removed, and the gate between the steam dryer pool and fuel transfer canal removed, the water level in the reactor will eventually drain down to the flange of the reactor vessel, but only if the coolant makeup water to the reactor well and the steam dryer pool has been cut off to reduce leakage through the failed seal. Because of the stainless steel secondary seal, catastrophic loss of the water in the upper pools is not possible. The RHR system would continue to maintain the water level in the reactor to the flange of the reactor vessel and continue to supply cooling to remove decay heat from the fuel. Therefore, there is no possibility of cladding damage to fuel residing in the reactor core. See Figure No. 3.

Fuel in transit can be safely stored should a leak occur. As noted above, the leak rate would be very small, and the Fuel Pool Cooling and Cleanup System supplies 300 gallons per minute to the pools. This will allow for transit of the fuel to the upper containment storage pool or back to the reactor vessel.

The maximum number of fuel assemblies which can be stored in the storage racks in the containment pool is 190. Assuming that these assemblies are maximum power assemblies, then each would have a decay heat output of 1.22×10^5 Btu/hr. This value is 1.25 times the average heat output of a core discharge 24 hours after shutdown and assumes a burnup of the fuel to 18,000 MWD/MT.

If the upper containment pools were allowed to drain down because the Fuel Pool Cooling and Cleanup system is shut off, and if the gate between the reactor well and the Steam Dryer Pool is not installed then the water level above the fuel assemblies stored in the containment storage racks would eventually fall to 5 feet. Because of the threshold step below the Steam Dryer Poolgate, 1.75 feet of this water would be in the Steam Dryer Pool and an additional 3.25 feet would be in the Fuel Transfer and Fuel Storage Pool.

A total of 89,200 gallons of stagnant water would be available for cooling. Assuming this water is at 120°F, it would require 3 hours to reach boiling. Thereafter the water would boil off at a rate of 2860 gal/hr. The water would boil to the top of the stored fuel assemblies after another 9 hours.

The above is a worst case scenario. Cladding damage, based on this scenario, would begin to occur approximately 12 hours after the water level drained down to the level indicated in Figure No. 3. Since the PNPP refueling bellows incorporates a secondary seal, failed bellows leakage is expected to be negligible and drainage to the level indicated in Figure No. 3 is not expected. Therefore, cladding damage without operator action is not possible.

It should be noted also that operation of the Fuel Pool Cooling and Cleanup System or RHR System can keep the water level above the stored fuel and thus prevent fuel cladding damage.

(5) Potential Effect On Stored Fuel and Fuel In Transfer.

See answer to (4) above.

(6) Emergency Operating Procedures.

If a failure of the bellows should occur while the reactor is operating, it will not be possible to determine the failure since the drywell head-drywell seal will prevent leakage from the upper containment pools.

The failure will become apparent when the reactor well is filled while preparing to refuel. Upon detection, the operator will need to assess whether or not the leakage has to be stopped. Leakage can be stopped by installing the reactor well-steam dryer pool gate and draining the reactor well. Operation of the RHR System and Fuel Pool Cooling System will assure that the fuel assemblies within the reactor core or fuel storage pool are covered with water and are being cooled.

REFUELING BELLOWS (VESSEL TO DRYWELL)	J.P.S. / DR. APP. / CHK'D DAK / ENG. APP. 1-6-75 / DATE 12-20-74 / W.O. 044549-080	GILBERT ASSOCIATES, INC. ENGINEERS AND CONSULTANTS READING, PA. / 04 4549 SS-300-707 DRAWING NUMBER / REV.

CONSTRUCTION	
BIDDING PURPOSES	DAK
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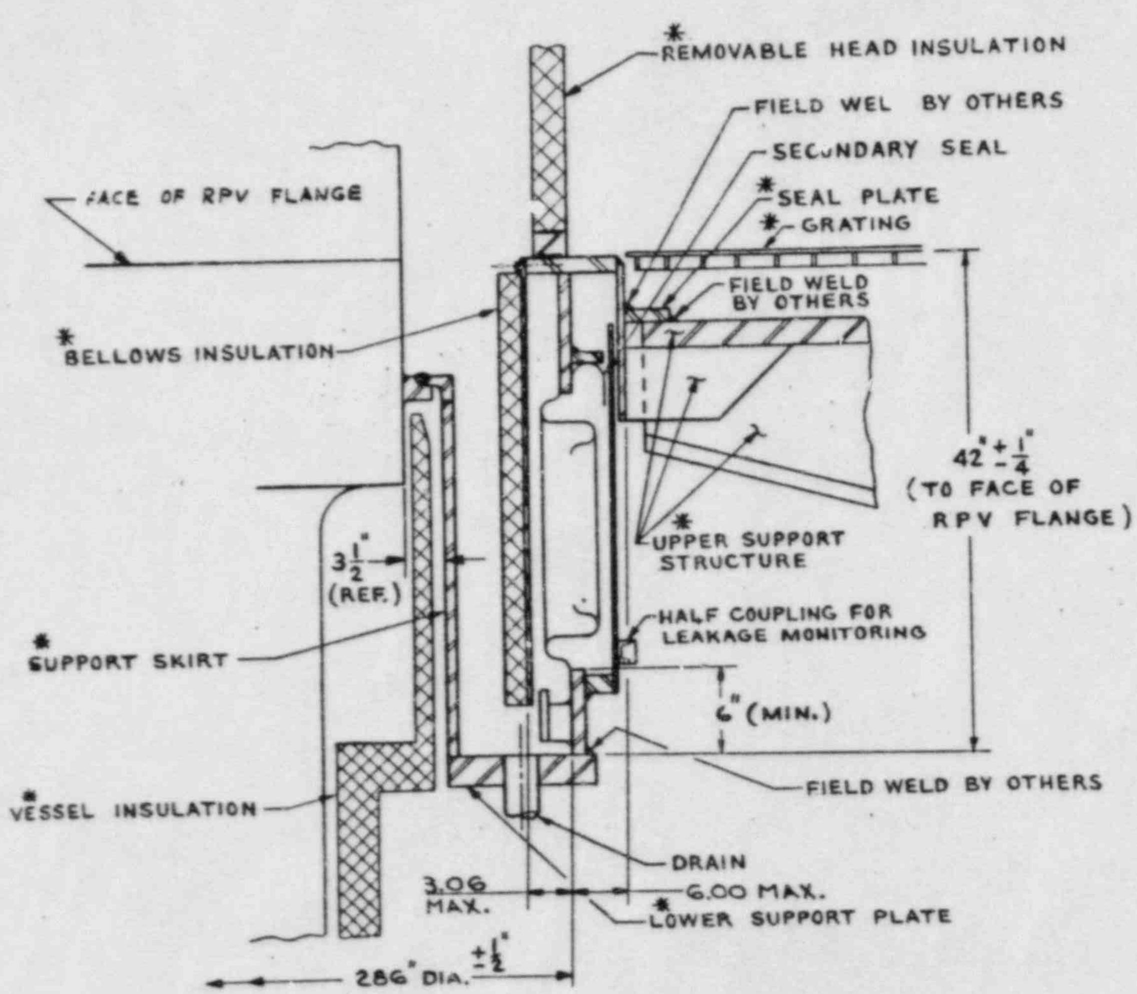
DATE	1-6-75

Fig No. 1



INFORMATION ONLY

NOTES:-

1. ALL DIMENSIONS IN INCHES.
2. ITEMS WITH ASTERISK ARE SUPPLIED BY OTHERS.

Fig. No. 2

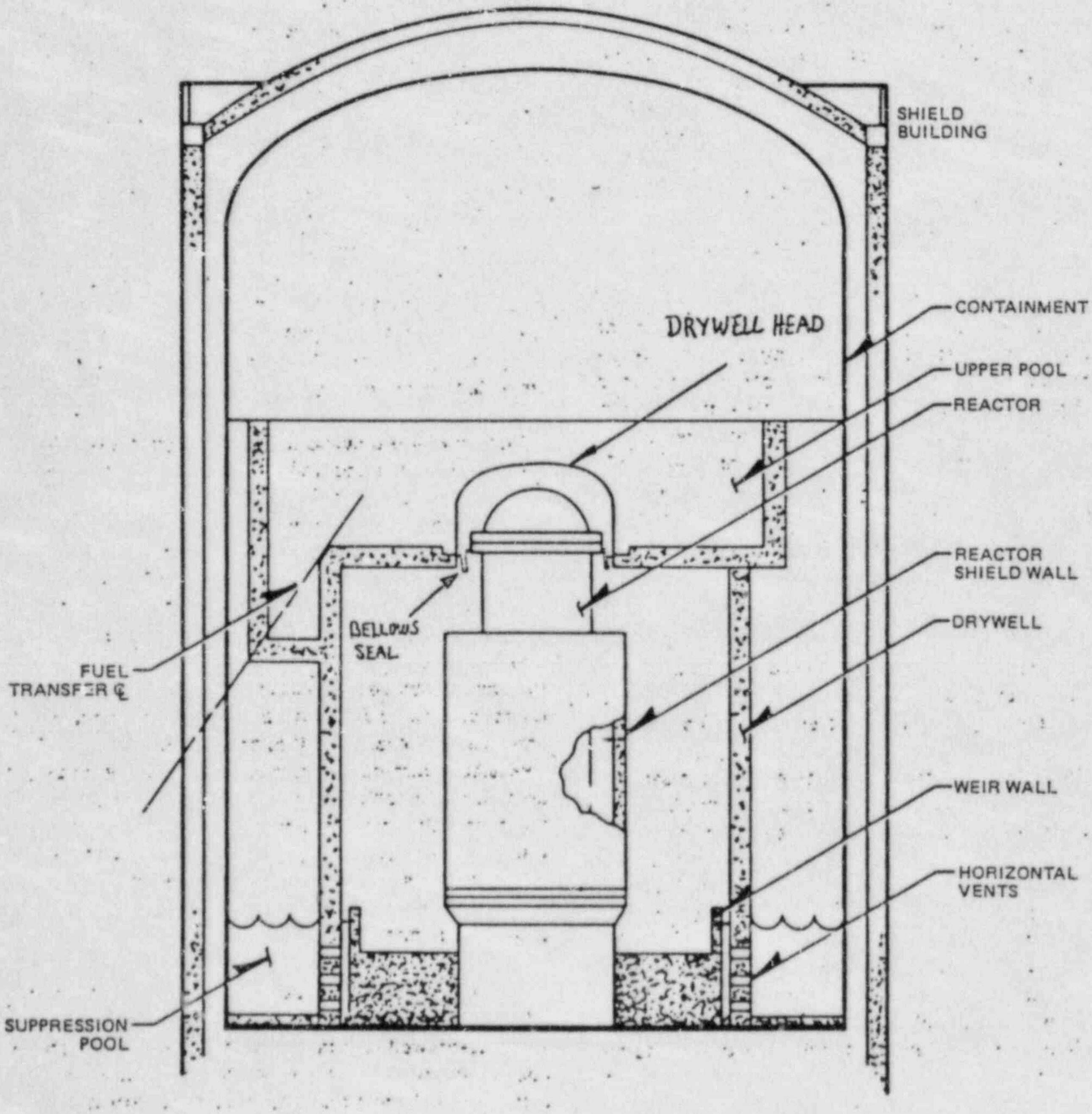


Figure 7-2. Reactor Building (Mark III Containment and Shield Building)

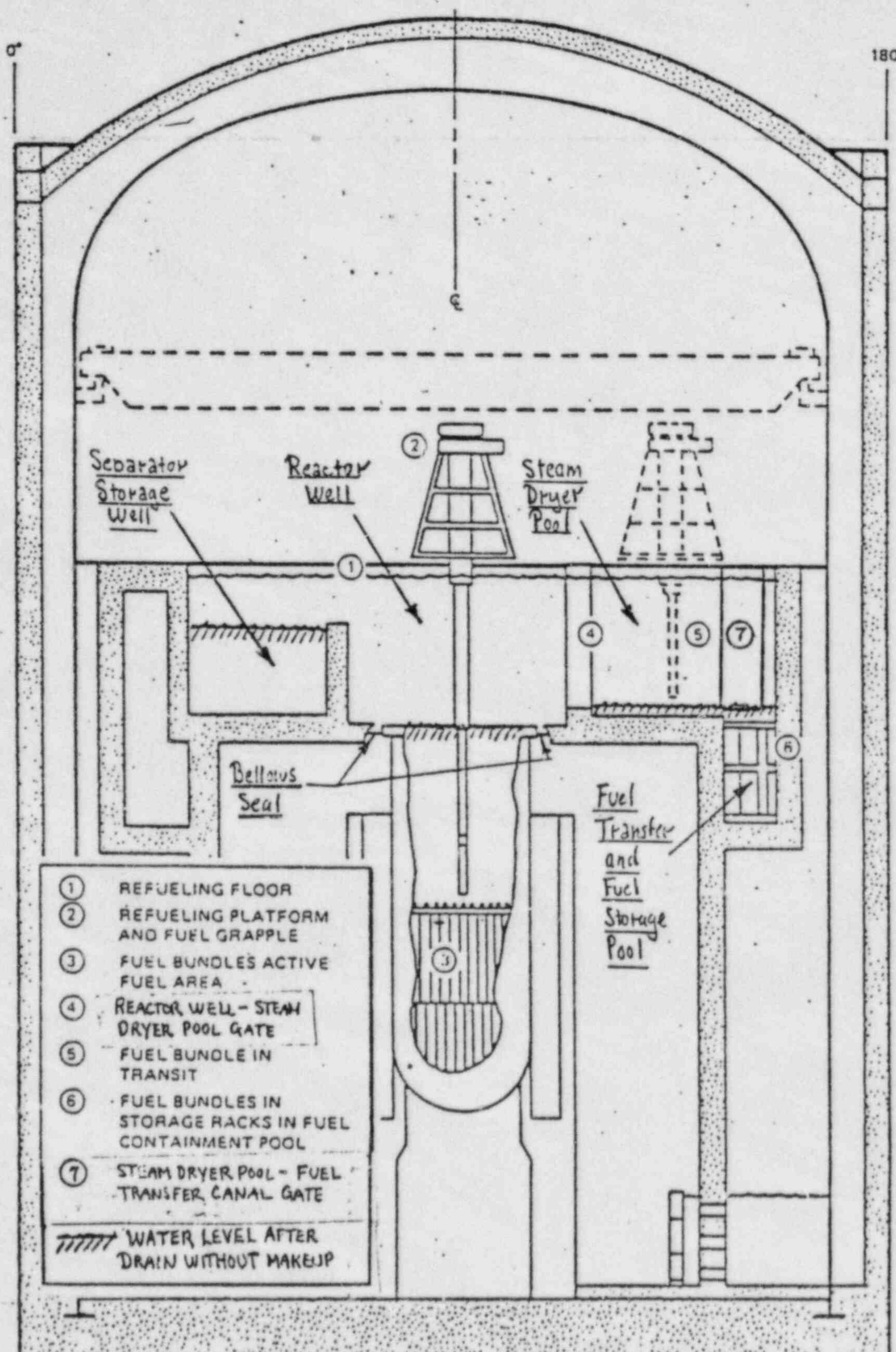


Figure No. 3 Fuel Bundle Transfer Sequence