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November 28, 1984

Dr. Thomas E. Murley, Regional Administrator
U.S. Nuclear Regulatory Commission
Region I
631 Park Avenue
King of Prussia, Pennsylvania 19406

Subject: IE Bulletin No. 84-03: Refueling Cavity Water Seal
R. E. Ginna Nuclear Power Plant, Unit No. 1
Docket No. 50-244

Gentlemen:

As requested in IE Bulletin No. 84-03: Refueling Cavity Water Seal, Rochester Gas and Electric hereby submits the following evaluations.

At the Ginna Nuclear Plant, a Presray Model PRS 585 molded fabric reinforced inflatable seal is used to effectively seal the annulus between the reactor vessel and the refueling cavity. The seal has performed satisfactorily since 1977 at which time it was first put into use. Although the inflatable portion of the seal used at Haddam Neck is of similar design to that used at Ginna, there are some distinct differences to contend with.

To begin with, the seal centerline diameter at Ginna is 172 1/2 inches as compared to 256 1/8" for Haddam Neck. This magnitude difference in diameter decreases the potential for possible seal misalignment at Ginna.

As per discussion with Presray Seal and Connecticut Yankee at Haddam Neck, there is a marked difference in the rigidity of the seals. The Haddam Neck seal has been noted by Presray to be more flexible than the Presray PRS 585 that is employed at Ginna. The rigidity of the Ginna seal makes it very unlikely for the seal to displace itself from the annulus area.

The double seal design at Haddam Neck is used to seal approximately a two foot gap between the reactor flange and the cavity wall. This is accomplished by the use of a steel seal ring between the two inflatable seals. The seal ring is supported by strongbacks at only nine specific locations around the circumference, and due to this arrangement, a scalloping or ripple effect can result. This condition can introduce a potential for misalignment. At Ginna, the seal is a single membrane, sealing a nominal 2 1/2 inch gap between the reactor flange and the cavity liner wall. The depth of the annulus at Ginna allows for greater surface contact of the inflatable seal (full surface contact on the cavity liner side and 2 1/2 inch surface contact on the reactor vessel flange). This is compared to a total 1 5/8 inch surface contact with the Haddam Neck application.

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The inflation pressure at Ginna is procedurally regulated at 30 psig. To prevent the possibility of overpressurization, a relief valve set at approximately 40 psig is employed. The net effect is that the seal will not undergo deformation due to overpressurization.

Due to the complexity in analyzing the mechanical properties of a fully inflated PRS 585 seal, short of performing a full-scale mockup, the following static experiment is offered (see attached Experimental Job Sheet). This study was performed by the seal manufacturer, Presray Corp. prior to initial seal usage. It is noted that the experimental test was performed to determine the effectiveness of the inflatable seal with a 25 foot head of water if the seal becomes deflated. This appears to be a more credible event at Ginna than the displacement of the seal mainly due to 1) the rigidity of the seal, 2) the specific application for which the seal has been designed by the manufacturer, 3) measures taken which preclude overpressurization. The results of the experiment conclude that the seal will not push through the opening.

If it can be postulated that the same event could occur at Ginna, inherent plant design characteristics will minimize the effect of seal failure. Assuming a quarter circumferential seal failure similar to that experienced at Haddam Neck, the resulting flow rate would be considerably less. This is due to the smaller annulus diameter at Ginna. Assuming worst case, with flow rates approaching those experienced at Haddam Neck and with a fuel assembly in the manipulator mast, operator action will be necessary to prevent fuel cladding failure. System design at Ginna assures that even with a seal failure and subsequent draining of the refueling cavity, sufficient water inventory will remain in the lower cavity and fuel transfer slot area to cover fuel that may be stored there. Since fuel assemblies can only be stored in either the RCC change fixture area, the fuel transfer upender or the manipulator mast, the only potential concern would be that of having an assembly in the mast. Recent analysis at H.B. Robinson indicate that fuel cladding damage will result in approximately twelve minutes for an exposed, irradiated assembly. This assumes total uncovery approximately fifty hours after irradiation. This fifty hour window is extremely conservative since normal system cooldown and cleanup precludes fuel movement within that short of a time frame. We have administratively addressed this concern of having an assembly in the mast by instructing refueling personnel to position the manipulator crane over a previously selected and marked location in the fuel transfer slot and to lower the assembly to the floor. This instruction was first introduced as part of the concern addressing the installation of the S/G nozzle dams two years ago. To date, these instructions have not been formally documented. A permanent change to the cycle specific refueling procedure will be incorporated into the 1985 procedure to address this area and formally present the emergency operation procedure to be followed. For the other two areas mentioned above, approximately one foot of water will remain covering the top of the vertical standing assemblies.

It is noted that the above postulated event will have no effect on the integrity of the fuel located in the core. Residual heat removal capabilities will not be effected and the core will experience no adverse effects.

The effect of seal failure on the stored fuel in the spent fuel pit without any operator action would be that no fuel uncovery would occur. Approximately 8 inches of water would remain covering the top of the fuel assemblies. With operator action, the manually operated fuel transfer gate valve would be closed to prevent unnecessary draining of the spent fuel pool. The most limiting case for fuel in transfer between the spent fuel pool and the refueling cavity would be that of placing an irradiated assembly in the upender and positioning the upender in the vertical position. Other than radiological consequences, no fuel or cladding damage will result. Approximately one foot of water will be covering the top of the assembly. Again assuming worst case, without any operator action, the minimum time frame for the beginning of fuel uncovery in the SFP would be approximately eight hours. This is based on present storage configuration volumetric dimensions and a maximum allowable decay heat rate of 12.0 MBTU/hr. Additionally, this eight hour criteria is based on the heating of the remaining water from 80°F to 212°F, with no credit taken for ambient losses. With operator action, the two fire pumps can be arranged to re-flood the pit at the rate of six inches per minute to a level above the suction piping for the spent fuel cooling cycle. This will take approximately 12 minutes to re-flood the SFP to allow normal spent fuel cooling to be reinstated.

As a concern to better understand nature of deflection of the inflated seals, we will commit to performing seal deflection measurements for the upcoming refueling outage. These will be taken with the seal installed in the annulus in both the deflated and inflated condition. This will provide us with valuable information regarding the direction of seal deflection, if any, with the seal installed.

In conclusion, at the Ginna Plant, although the potential exists for seal failure, existing system configuration and operating procedures negates the consequences of fuel uncovery. Again it is restated that operator action is necessary to prevent fuel uncovery in the event that a fuel assembly is in the mast of the manipulator crane at the time of the event. For all other refueling activities, with seal failure, the lack of water shielding will result in high radiation fields, however, any effect to the health and safety to the general public will be negligible.

Very truly yours,

Roger W. Kober

Roger W. Kober

Subscribed and sworn to me
on this 28tg day of November 1984

LYNN I. HAUCK
NOTARY PUBLIC, State of N.Y., Monroe County
My Commission Expires March 30, 1986

Enc.

xc: U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

DATE November 28, 1984
TO Dr. Thomas E. Murley

EXPERIMENTAL JOB SHEET

PURPOSE: To determine the deflection of a PRS 585 seal under a 25 foot head of water when seal inflation pressure fails.

PLAN: Prepare a test fixture that will accept a PRS 585 seal with a 2 1/2 gap and a means to simulate a 25 foot head of water.

APPROACH: The net hydrostatic load on the seal is distributed over the 2 1/2 inches of the seal flange directly over the 2 1/2" gap hydrostatic pressure is .4335 psi per foot of water. Using a 6 inch long test fixture, the total test pressure is determined by:

2 1/2 x 6 x .4335 x 25 = 162.562"

or 27.094 lbs per linear inch

Using a conservative approach, a 180 lb. force was applied to a 1 inch section along the seal Ø.

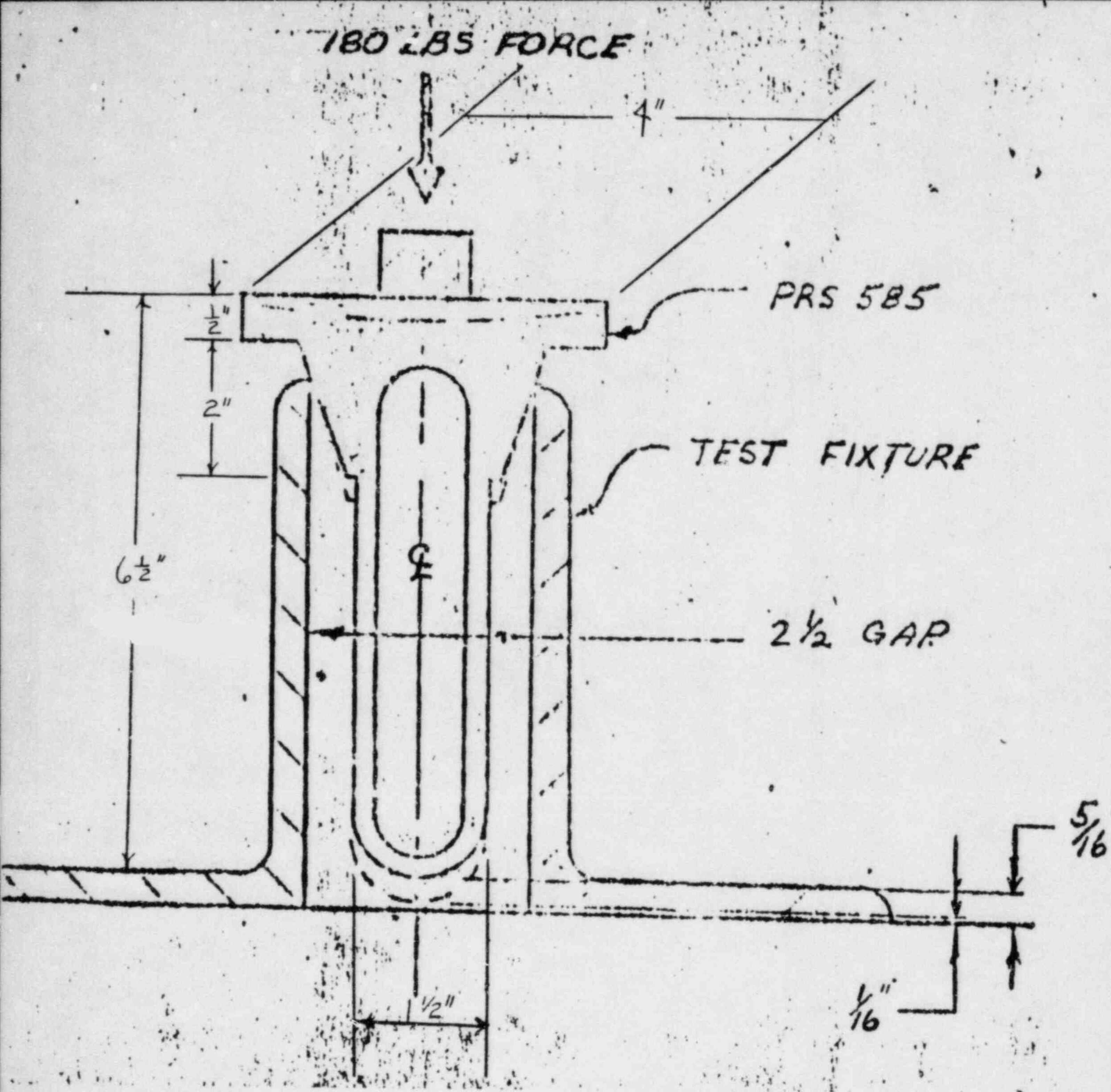
TOOLING:
1 Test fixture 6" lg. (See Sketch, Sht. 2)
1 PRS 585 sample 6" lg.
1 3/4 x 1 x 6 bar

PROCEDURE: (See Sketch, Sht. 2)

1) Set fixture at 2 1/2" gap
2) Place seal in fixture
3) Place bar on seal centerline
4) Apply force
5) Measure seal deflection at base of bulb

RESULTS: Seal deflection 1/4 inch

CONCLUSION: The PRS 585 will seal effectively against a 25' head of water if the seal becomes deflated. The wedge shape of the seal flange will act as an effective "stopper". As the water pressure increases the wedge will become more firmly set. Under the conditions outlined, the seal will not push through the opening.


180 LBS FORCE
4"
PRS 585
1/2"
2"
TEST FIXTURE
6 1/2"
℄
2 1/2 GAP
5/16"
1/2"
1/16"