PP&L Pennsylvania Power & Light Company
Two North Ninth Street • Allentown, PA 18101 • 215 / 770-5151

Bruce D. Kenyon
Vice President-Nuclear Operations
215/770-7502

NOV 26 1984

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

SUSQUEHANNA STEAM ELECTRIC STATION
IE BULLETIN 84-03 RESPONSE
ER 100450/100508 FILE 842-03
PLA-2363

Docket Nos. 50-387
and 50-388

Dear Dr. Murley:

This letter and its attachment provide PP&L's response to IE Bulletin 84-03 "Refueling Cavity Water Seal". The conclusion of our evaluation of the potential for and consequences of a refueling cavity (reactor well) water seal failure are provided in the attachment.

We trust that this response will be satisfactory.

Very truly yours,

B. D. Kenyon
Vice President-Nuclear Operations

Copy to:
Mr. Richard C. DeYoung
Director-Office of Inspection & Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. R. H. Jacobs
U.S. Nuclear Regulatory Commission
P.O. Box 52
Shickshinny, PA 18655

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

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AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA)
: SS
COUNTY OF LEHIGH)

I, BRUCE D. KENYON being duly sworn according to law, state that I am Vice President, Nuclear Operations of Pennsylvania Power & Light Company and that the facts set forth on the attached response to IE Bulletin 84-03 are true and correct to the best of my knowledge, information and belief.

B D Kenyon
Bruce D. Kenyon
Vice President, Nuclear Operations

Sworn to and subscribed before me this 26th day of November, 1984.

Martha C Barto
Notary Public

MARTHA C. BARTO, Notary Public
Allentown, Lehigh County, Pa.
My Commission Expires Jan. 13, 1986

jlt/msc2003681

Introduction

This report provides the results of PP&L's evaluation of the potential for and consequences of a refueling cavity water seal failure per the requirements of IE Bulletin 84-03, "Refueling Cavity Water Seal".

Normal Reactor Well Conditions

The six (6) foot thick spent fuel pool walls provide radiation shielding to 2.5 mrem/hr measured on the outside of the spent fuel pool walls. Normal water shielding over the stored fuel is approximately 23 feet and is sufficient to provide shielding for required building occupancy. Under normal water level conditions, approximately 8.5 feet of water is above the active fuel when moved through the refueling channel. This depth of water provides shielding to assure less than 2.5 mrem/hr to the operators on the refueling platform. The positioning of the neutron poisoning material (boral) between each adjoining fuel assembly in the spent fuel pool assures subcriticality by at least %5 delta-K under all normal and abnormal conditions.

Susquehanna SES Reactor Well Water Seal

The Susquehanna SES Reactor Well Water Seals are situated one above the other in a narrow annulus about the reactor well (see Figures 2A & 2B). The two nylon reinforced synthetic rubber seals are approximately 42' 8" in diameter and weigh about 540 lbs. each. The seals are manufactured by Presray Corporation and prevent leakage from the reactor well to secondary containment (see Figure 2B). The reactor well seals are inflated by instrument air (maximum system pressure is 107 psig) during refueling operations to effect this seal. The seal air supplies consist of individual flex hoses, embedded 1" pipe (in Cat 1 concrete), inflate/deflate valves, check valves, pressure regulators, and a common air header. As a result, everything downstream of the common air header is redundant. A keeper is located under the lower seal which helps to maintain this seal's position in the annulus (see Figure 2C). The upper seal's wedge design precludes its slippage. Prior to refueling operations with the reactor well seals inflated. the annulus area between the seals will be pressurized via a testing tap to a pressure equal to the static head of a full reactor well cavity to check for leakage.

The Susquehanna Reactor Well Seals were designed to accommodate all credible crevice deflections (including seismic and hydrodynamic) without leaking. The maximum temperature is 212 deg F and the calculated burst pressure at this temperature is over 300 psig. The active components involved in performing the seal function are the air compressors and other components which supply air for inflating the seals via the instrument air system. The individual lines to each seal are furnished with check valves.

Vendor documents show that the seals have been extensively tested. For example, a cyclic loading test was performed during 1974/75 in which a seal was inflated to 20 psig and deflated 1,500,000 times without failing.

More importantly a "dead load" qualification test was performed. This test was intended to prove that a failure, such as was experienced at Connecticut Yankee, could not happen at SSES. On 4/4/79 Presray conducted this test by attempting to force a seal through a 3-1/2" gap (3-1/2" is the postulated post seismic gap between the Drywell and the Reactor cavity which represents the sum of the design width of the gap plus the maximum construction tolerance and the calculated seismic deflection). The maximum head of water that could be seen by the seal is 25 feet (distance from seal to the refueling floor.) A safety factor of 3:1 was used so a force of 75 feet of water, or 33 psig, was applied to the top of the seal. A maximum deflection of 1/2" was noted at the top of the seal. It was not forced through the gap.

A hollow area, directly beneath the lower reactor well seal, contains leak detection lines that collect any water that accumulates in the area (see Figure 2A). The leak detection lines join at a common header which directs leakage to the liquid radwaste system. Any leakage will be sensed via a level switch which will annunciate a reactor well seal leak detection alarm on local control panel 0C211. This alarm informs the operators of possible seal failure. Any leakage past the top seal that has collected in the space between the two seals can be detected by opening a valve which allows flow through a flow indicating switch. This switch also produces an alarm on local panel 0C211. Reactor well water level is monitored visually from the refueling floor and by a locally indicating static pressure type device. Fuel pool water level is continuously monitored by a level element which provides high and low level alarms on local panel 1C211. No inlets, outlets, or drains are provided that could conceivably cause the fuel pool to be drained to a level below the top of the stored fuel. This includes seal failure. All the above local alarms are duplicated individually or as group alarms in the main control room.

Makeup for evaporative and small leakage losses from the fuel pool is normally supplied from the Demineralized Water system to the skimmer surge tanks of each unit. The skimmer surge tank provides NPSH for the fuel pool cooling pumps and the RHR pumps. It provides sufficient capacity for three days (7500 gallon capacity) normal evaporative loss from the fuel pool without the makeup mentioned above. The intermittent flow rate is approximately 50 gpm to each surge tank. Makeup water is also available through two separate 8" fuel pool headers from the RHR system at a flowrate of at least 6000 gpm. A seismic category I 2" makeup line from each ESW loop provides additional makeup capability. The design makeup rate from each ESW loop is 60 gpm. As a fourth source, the Refueling Water Transfer pumps could be used with a flow slightly less than 1500 gpm each.

Comparison of Susquehanna SES Seal Design With Hadam Neck's Seal Design

The seal failure mechanism at Haddam Neck appears to be something that is associated with their design and is not applicable at Susquehanna. The attached figures illustrate the differences between the two types of seal designs. The most obvious advantage of the Susquehanna design is the redundant seal configuration. Both designs contain two seals manufactured by Presray, Inc.; however, the Susquehanna design is such that either seal can prevent reactor well leakage by itself. Another important difference between the two designs is somewhat less obvious. The Susquehanna seal design utilizes a crevice to house the seals, whereas the Haddam Neck design suspends its seals between two plates. The Haddam neck configuration allowed the bottom portion of the seals to "balloon" (since there was not a continuous surface to bear against). This ballooning effect caused the top of the seal to concave which reduced the width of the top portion and enabled the seal to slip through the gap. The Susquehanna crevice design provides a continuous surface along the length of the seal which prevents this ballooning effect.

Evaluation of Susquehanna Reactor Well Seal Failure Mechanisms

PP&L believes that leakage of the reactor well water seals is a very low probability event if the seals are maintained properly. Rapid drainage of the reactor well due to gross seal failure is not credible. Any gross failure of the seals would require multiple failures since the seal design has redundant features. In addition, the lower seal's keeper and the upper seal's wedge design provide an effective means of reducing or limiting leakage should multiple failures occur. If a gross failure of both seals occurred at Susquehanna, then the potential consequences could be severe. These consequences are difficult to quantify due to the number of variables involved and differences in the corresponding assumptions that could be made. Since rapid drainage of the reactor well at Susquehanna is not credible an assessment of the consequences of such an event is unwarranted.

As a result of an evaluation of the reactor cavity water seal design by PP&L's Nuclear Safety Assessment Group, several concerns regarding the preventative maintenance, inservice inspection, testing, and leakage detection/monitoring of the seals have been identified. PP&L will evaluate these concerns and implement any necessary corrective actions. These concerns do not invalidate PP&L's position that rapid drainage due to gross seal failure is not credible.

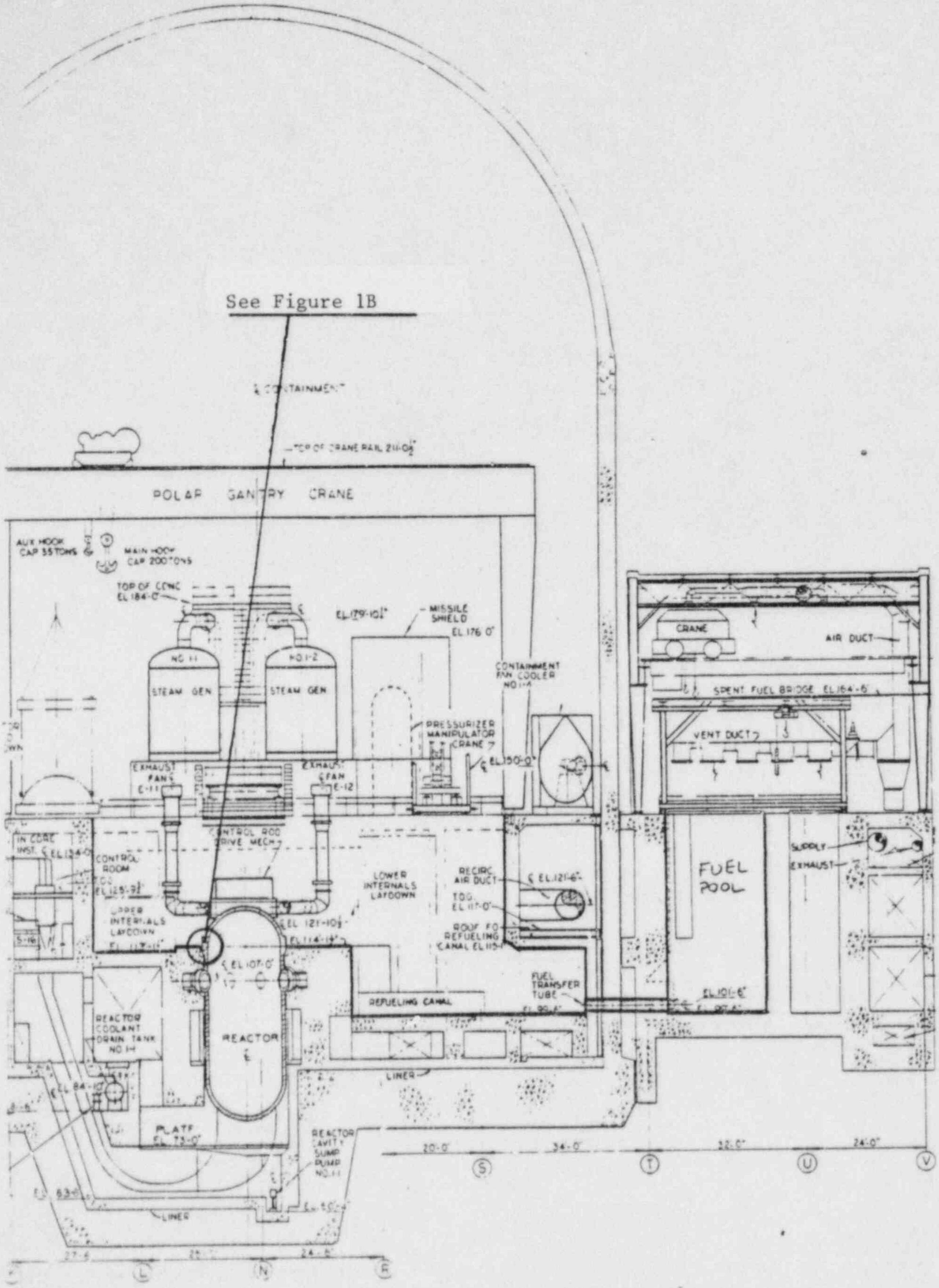

FIGURE 1A
TYPICAL WESTINGHOUSE PWR

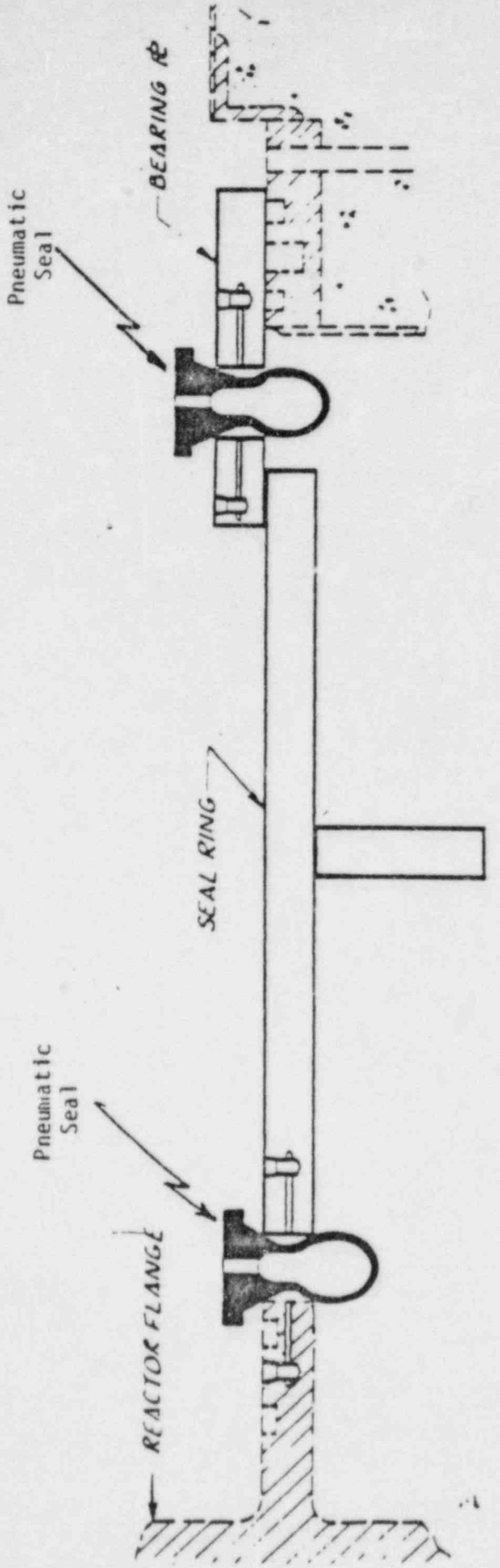

FIGURE 1B
HADDAM NECK REFUELING CAVITY WATER SEAL

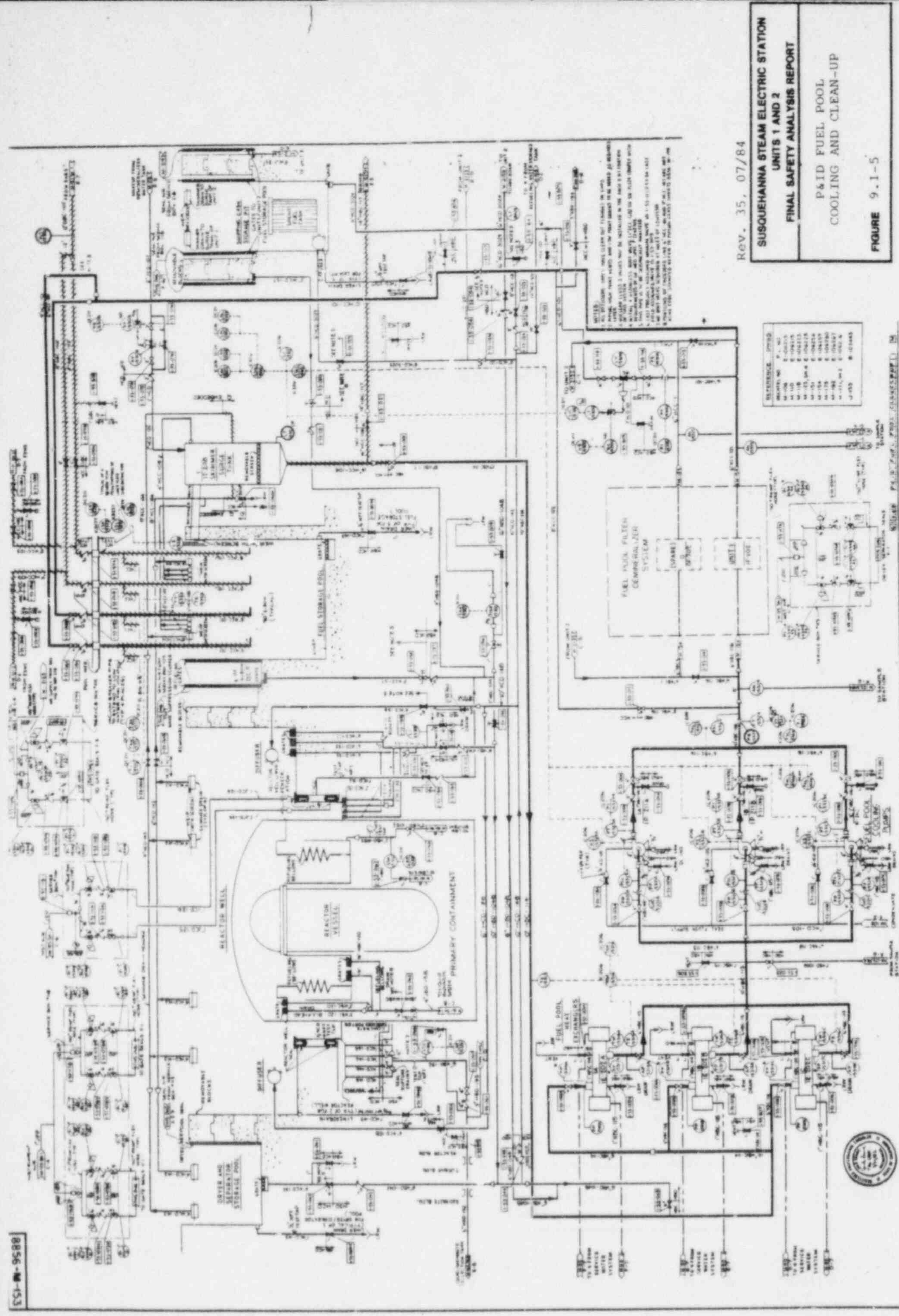

FIGURE 2A
P&ID FUEL POOL COOLING & CLEANUP

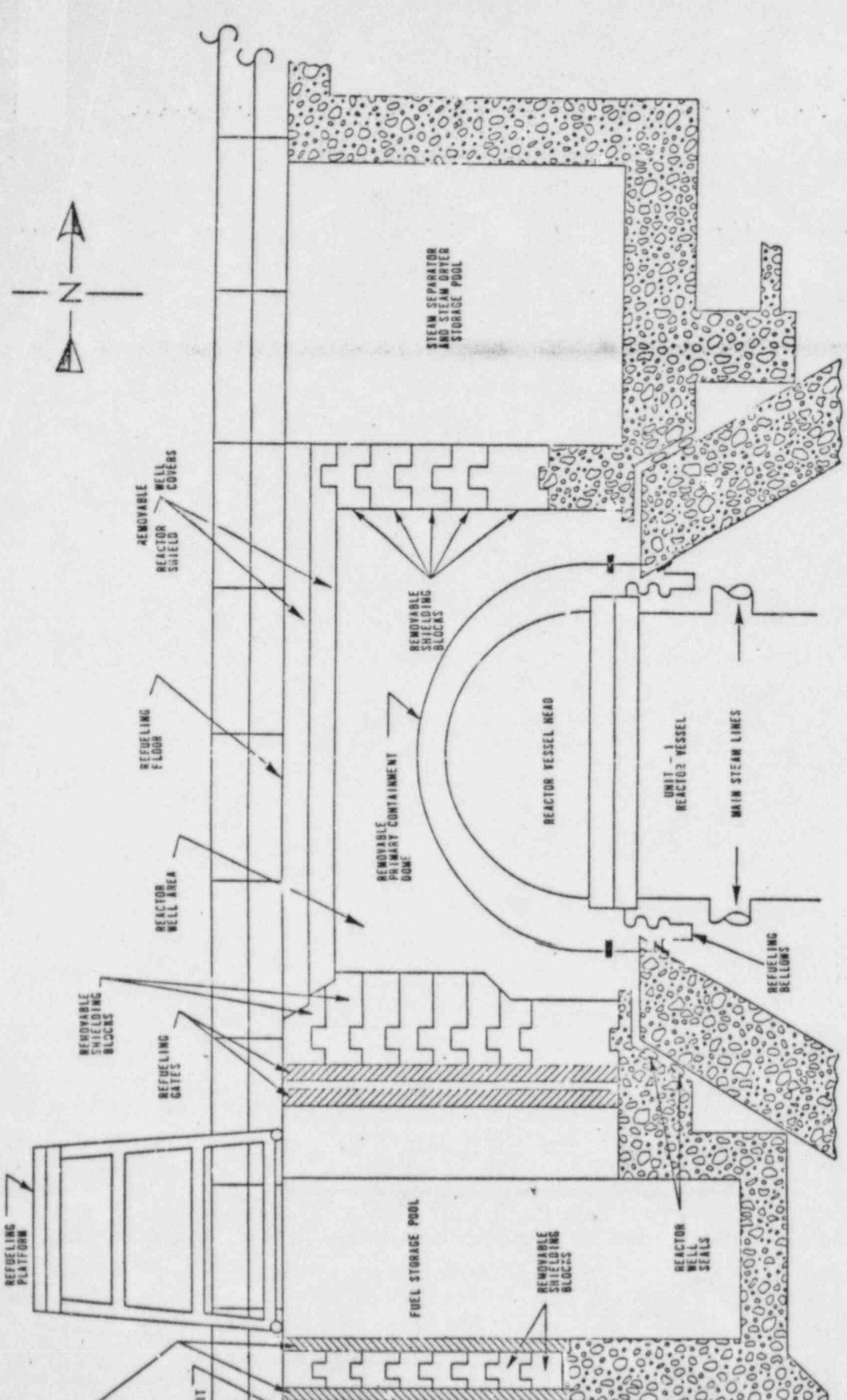

FIGURE 2B
REFUELING FLOOR CUTAWAY

FIGURE 2C
REACTOR CAVITY SEAL