BALTIMORE
GAS AND
ELECTRIC

CHARLES CENTER • P. O. BOX 1475 • BALTIMORE, MARYLAND 21203

December 4, 1984

ARTHUR E. LUNDVALL, JR.
VICE PRESIDENT
SUPPLY

Office of Inspection and Enforcement
Attention: Mr. R. C. DeYoung, Director
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Response to IE Bulletin 84-03
Refueling Cavity Water Seal

Gentlemen:

In response to IE Bulletin 84-03, we evaluated the potential for refueling cavity water seal failure. A summary report of our evaluation is attached.

We found no credible failure of safety significance. If you have any additional questions on this matter, please do not hesitate to contact us.

Very truly yours,

Arthur E. Lundvall Jr.

AEL/MDP/vf

Enclosure

cc: D. A. Brune, Esq.
G. F. Trowbridge, Esq.
Mr. D. H. Jaffe, NRC
Mr. T. Foley, NRC

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SUMMARY REPORT ON

REFUELING POOL SEAL SAFETY EVALUATION FOR

CALVERT CLIFFS NUCLEAR POWER PLANT

REQUIREMENT

Inspection and Enforcement Bulletin 84-03 required that Baltimore Gas and Electric Company "evaluate the potential for and consequences of a refueling cavity water seal failure and provide a summary report of these actions." The bulletin stipulated that such evaluations "should include consideration of: gross seal failure; maximum leak rate due to failure of active components such as inflated seals; makeup capacity; time to cladding damage without operator action; potential effect on stored fuel and fuel in transfer; and emergency operating procedures."

REFUELING POOL SEAL DESIGN

The refueling pool seal, (refer to Figure 1) consists of a single steel ring placed in the opening between the reactor vessel flange and the refueling pool floor. It rests on six support brackets (Detail 1) equally spaced around the vessel. A one-inch annular gap exists between the inside of the ring and the reactor vessel and between the outside of the ring and the seal ring ledge at elevation 44'-0" of the refueling pool. These gaps are sealed by two m-shaped silicone rubber seals, each one enveloped by nine steel channel seal covers placed end-to-end around the circumference of the seal assembly. The covers are held down by 45 clamps spaced equally around the outer seal and 36 clamps similarly arranged on the inner seal.

The seal ring is a circular steel plate welded to the top of a 10WF72 beam. The beam rests on support brackets of 12WF53 imbedded 1.5 feet into the reactor vessel cavity wall. Alignment pegs and the channel clamps establish proper azimuthal and concentric positioning of the ring. The weight of the assembly (16,712 pounds), prevents shifting of the ring. Thus, the ring acts as a rigid, integral part of the pool structure.

The installation of the seal assembly is governed by quality controlled maintenance procedures which specify the sequence of steps to be taken. Appropriate precautions are taken, including the inspection and cleaning of the seating surfaces, clamp torquing, and pressure testing. The reactor vessel cavity tell-tale drain line is checked while the refueling pool is being filled.

Once a satisfactory seal is established and the refueling pool is flooded, the static head developed by the water in the refueling pool adds to the seating force on the seal. There are no active components to fail.

The refueling pool communicates with the spent fuel pool via a transfer tube, which is normally closed by a manually operated gate valve. A transfer carriage is used to transport fuel assemblies between the two pools. Operation of the fuel handling equipment is discussed in the Calvert Cliffs Final Safety Analysis Report (FSAR) section 9.7. A copy of FSAR Figure 9-12 is attached.

CONSIDERATION OF GROSS SEAL FAILURE AND MAXIMUM LEAK RATE DUE TO ACTIVE COMPONENTS

For the purpose of this evaluation, we considered various potential seal failure initiators. There are no active components in the refueling pool seal system at Calvert Cliffs. Since the design of the silicone seal precludes displacement of the seal through the gap into the reactor vessel cavity (see Detail 1), gross failure would require displacement of the clamps and channels associated with the seal. Loads large enough to accomplish such damage are, in general, not permitted over the refueling pool by Calvert

Cliffs procedures for the control of heavy loads. Of course, the upper guide structure is sufficiently large and must be moved over the seal, but this structure is not normally moved while the transfer tube is open and must be moved prior to any fuel movement. Failure of the seal under these conditions would not uncover any fuel.

No other objects are moved over the seal which could transmit sufficient energy to the seal to produce a gross failure. We assume for our analysis that one clamp could be caused to fail by some unidentified mechanism or could suffer a passive failure. We further assumed that, as a result, the seal between the affected clamp and adjacent clamps would no longer be available to seal the opening between the seal ring and the vessel flange or the seal ledge of the pool floor. Since at least three other clamps would still be available to hold the affected channel, it was assumed to remain in place.

MAKEUP CAPACITY

Makeup requirements were considered for three regions: the Reactor Coolant System (RCS) (assumed to be open to the refueling pool and drained to the flange), the spent fuel pool, and the refueling pool cavity (where fuel may be in the upender machine).

RCS makeup requirements will be nominal and may be accommodated by the shutdown cooling system (with the chemistry and volume control system as a backup).

Makeup water can be supplied to the spent fuel pool indefinitely at a continuous rate of 160 gpm, and at short term rates up to 1390 gpm from each of two spent fuel cooling pumps taking suction on the refueling water tanks (RWTs). One RWT may be nearly empty (having been used to fill the refueling pool), while the other RWT would normally contain a minimum of 400,000 gallons to support operation of the other unit.

POTENTIAL EFFECT ON STORED FUEL AND FUEL IN TRANSFER

Consideration was given to the potential consequences of a refueling pool seal leak on spent fuel stored in the spent fuel pool or in the transfer carriage which is moved from one pool to the other via the transfer tube. The transfer tube isolation gate valve is manually operated from a valve operating station adjacent to the spent fuel pool. This valve cannot be shut unless the transfer carriage is in the spent fuel pool.

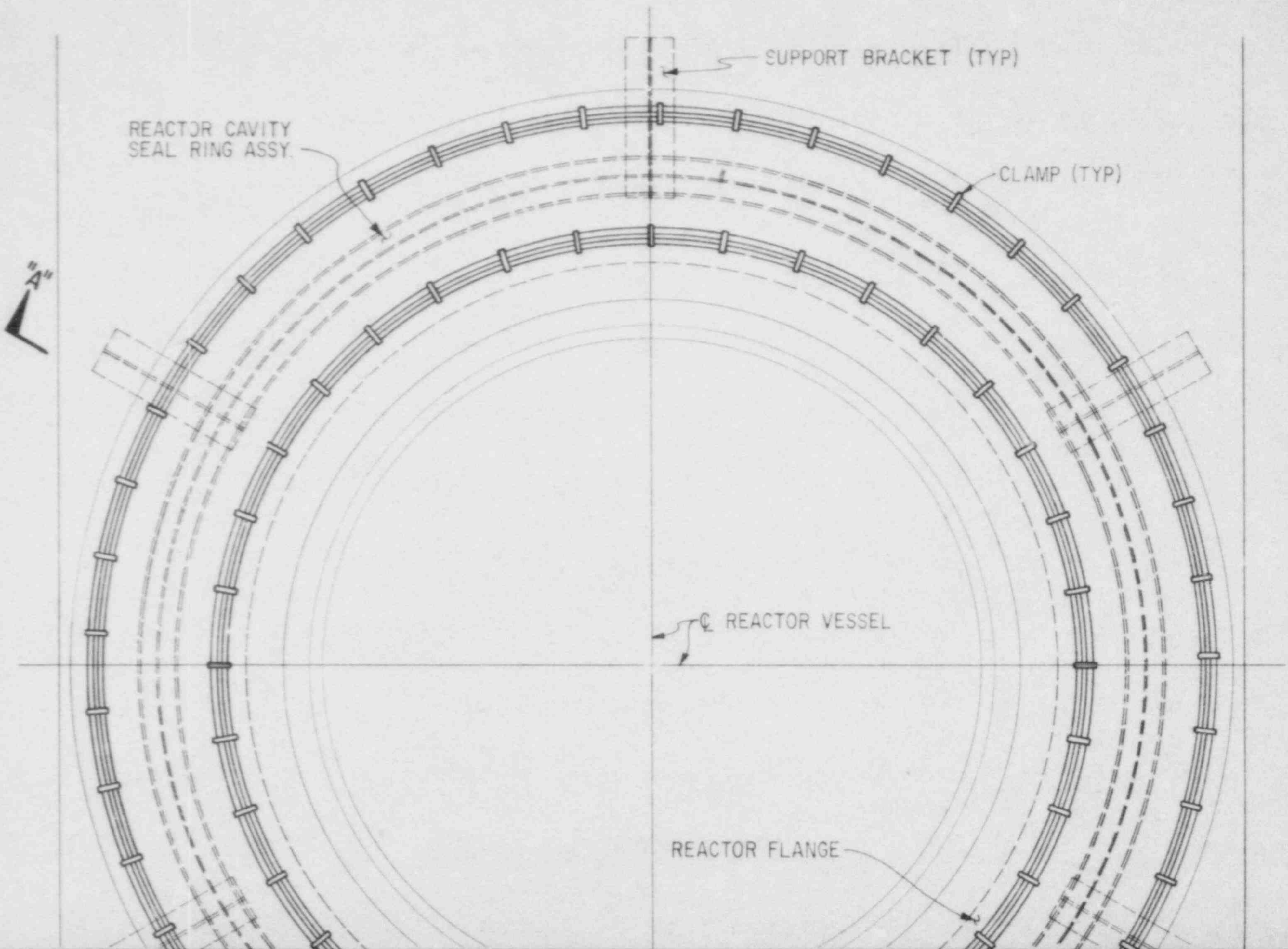
The fuel stored in the spent fuel pool would not be damaged so long as it is submerged. The refueling pool seal elevation is the spent fuel pool. As a result, even if a hypothetical refueling pool leak went unchecked and the transfer tube were not shut, the spent fuel would remain covered. Dose rate in the vicinity of the spent fuel pool would, however, be high, complicating recovery from the event.

We have calculated that adequate time is available to retract the transfer cart and to isolate the transfer tube. These computations were performed using a computer code for dose calculation and assuming a dose rate at the valve operating station from a full, freshly irradiated core located in the area of the spent fuel pool closest to the operator. Retraction of the transfer carriage may be complicated by viscous drag due to flow from the spent fuel pool into the refueling pool; however, as noted in the previous paragraph, failure to retract the cart and isolate the tube would not result in a hazard to public health and safety.

The time to fuel damage without operator action was calculated, but this scenario would require multiple and unreasonable violations of procedure. Throughout the transfer process and under credible circumstances, the fuel remains submerged and dose rates to the operator are maintained at acceptable levels. This is true even in the case where power is lost to the fuel handling machinery, since the machinery can be manually operated. Fuel handling procedures specifically address actions to be taken on unexplained increased or decreases in the level of the refueling pool or the spent fuel pool.

CONCLUSIONS

Refueling pool leak rates were calculated, and even assuming that no makeup water would be available and that electrically powered fuel handling equipment would be operated in its (slower) manual mode, sufficient time is available to ensure that all fuel remains adequately cooled and that operators in the spent fuel pool and the refueling area would not be exposed to unacceptable radiation levels. Existing procedures provide direction to the operator in responding to a loss of level in the refueling pool.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CLAMP (TYP)
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℄ REACTOR VESSEL
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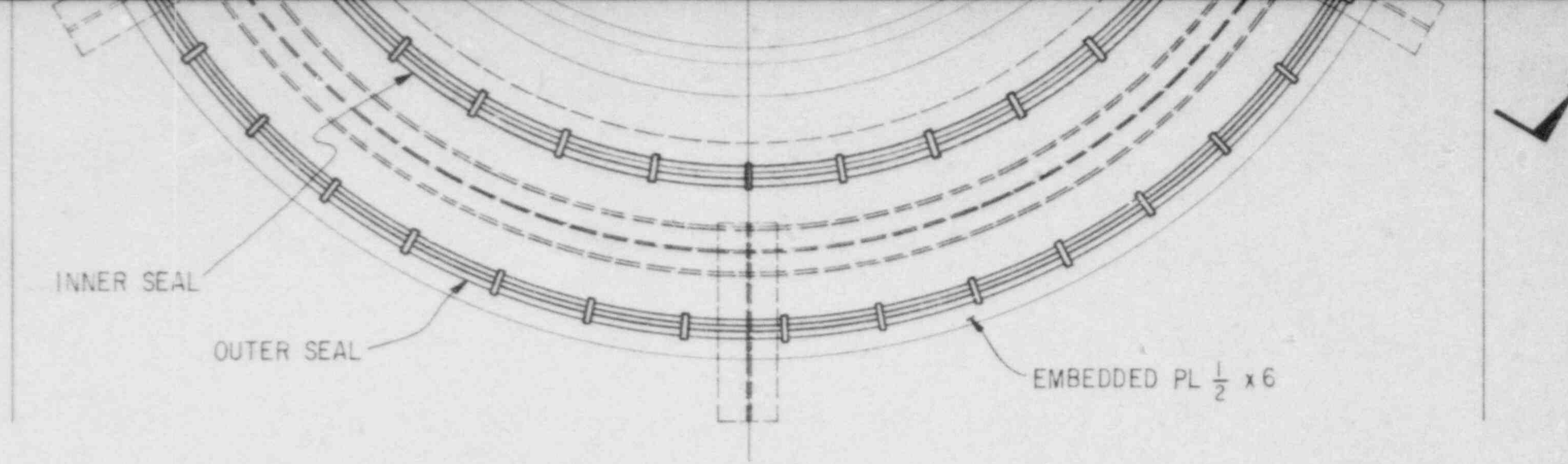
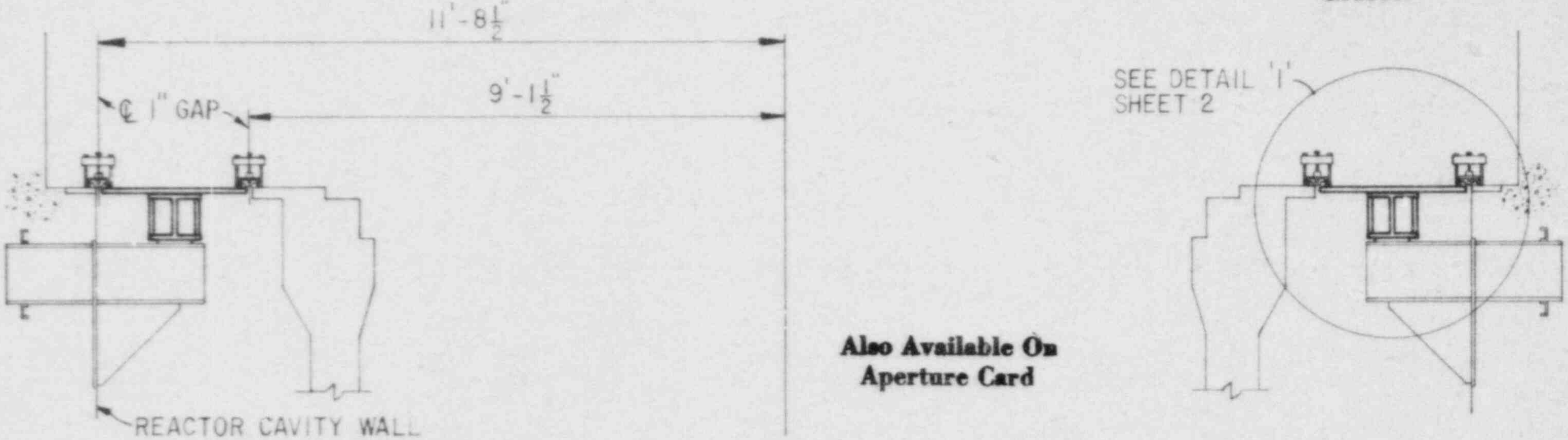


PLAN



SECTION "A-A"

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REACTOR VESSEL POOL SEAL ASSEMBLY

CALVERT CLIFFS NUCLEAR POWER PLANT
BALTIMORE GAS AND ELECTRIC COMPANY

NRC IEB 84-03 RESPONSE SKETCH SHEET 1

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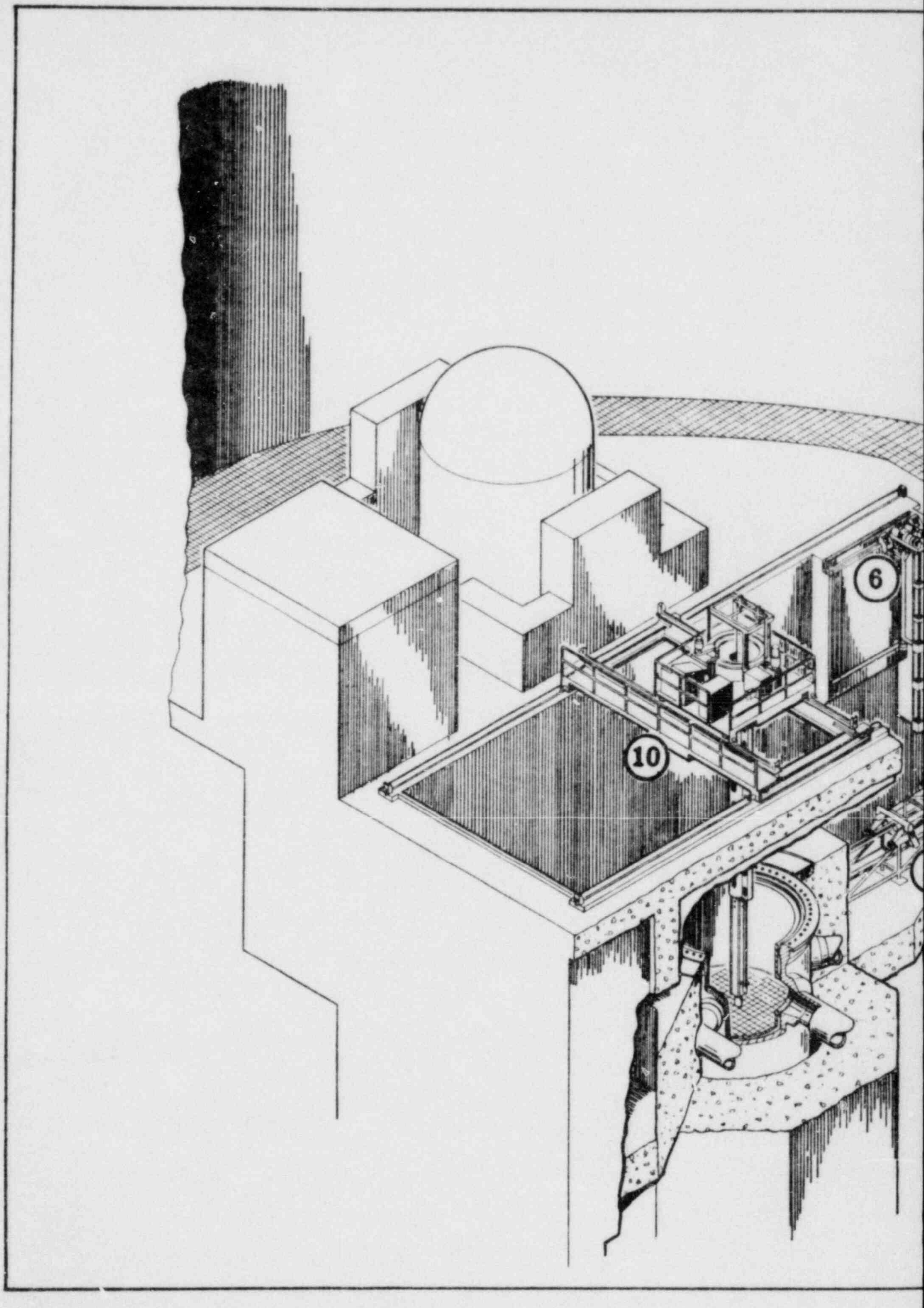
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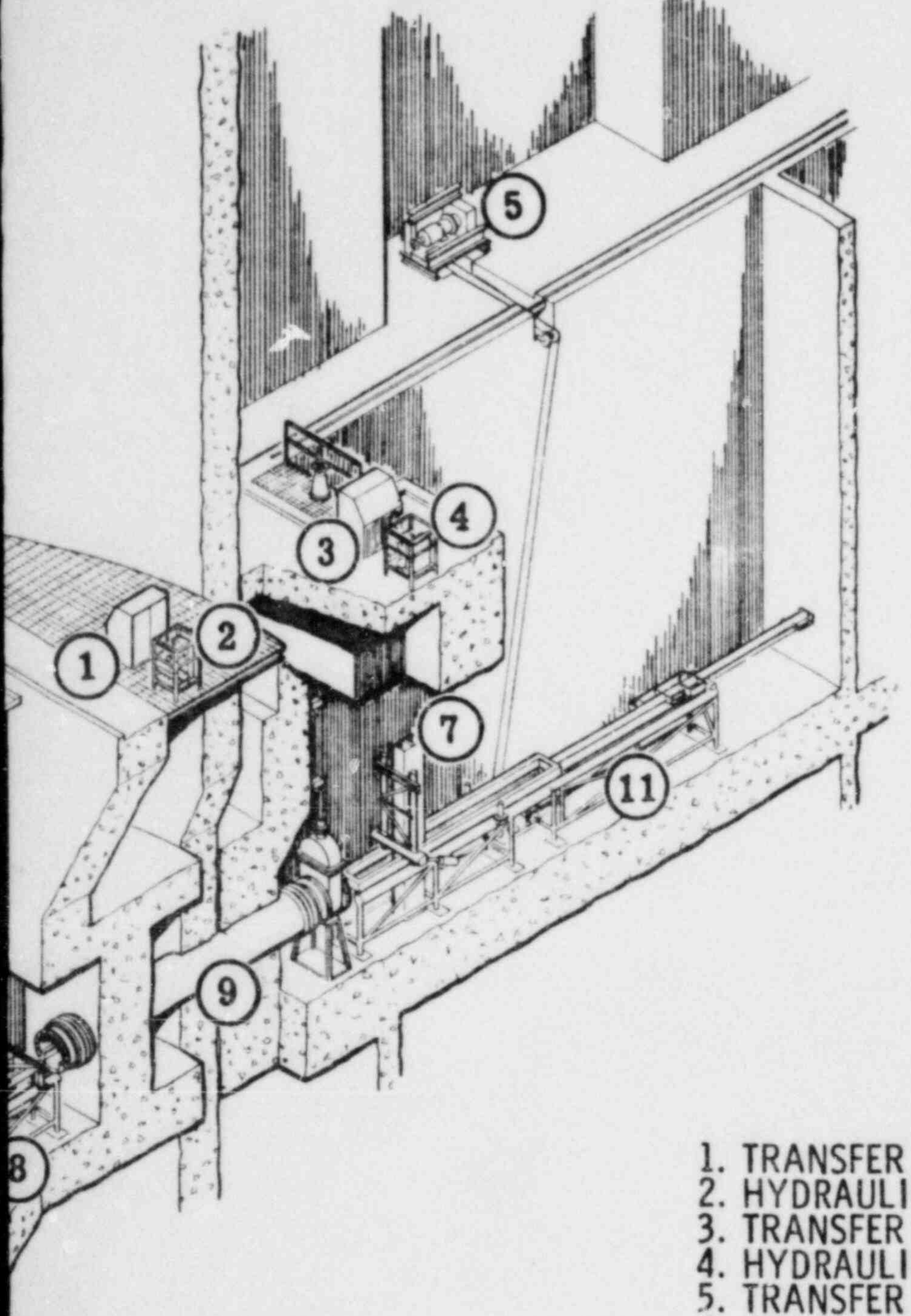

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APERTURE
CARD

1. TRANSFER MACHINE CONSOLE
2. HYDRAULIC POWER PACKAGE
3. TRANSFER MACHINE CONSOLE
4. HYDRAULIC POWER PACKAGE
5. TRANSFER MACHINE WINCH ASSY
6. CEA CHANGE MACHINE
7. FUEL CARRIAGE
8. UPENDER
9. TRANSFER TUBE
10. REFUELING MACHINE
11. TRANSFER MACHINE

Also Available On
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8412070234-02

BALTIMORE GAS & ELECTRIC CO. Calvert Cliffs Nuclear Power Plant	Refueling Equipment Arrangement	Figure 9 - 12