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US Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
TMI-2 Cork Seam

Dear Sirs:

The purpose of this letter is to provide the NRC a summary of the actions taken to modify the cork seam joint at TMI-2 (Attachment 1). This information is being provided as a followup to discussions between the NRC NRR staff and GPU Nuclear that took place on January 5, 1994.

Please contact John Schork, TMI Licensing Engineer, at (717) 948-8832 if you have any questions regarding this report.

Sincerely,

T. G. Broughton
Vice President and Director, TMI

JSS/emf

Attachment

cc: M. G. Evans - TMI Senior Resident Inspector
L. H. Thonus - Project Manager
T. T. Martin - NRC Regional Administrator, Region I





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# TMI-2 CORK SEAM MODIFICATIONS

## BACKGROUND

The TMI-2 cork seam is a construction joint between the various major facility structures. Its purpose is to allow for differential expansion between the adjoining building structures and to attenuate any vibration or movement that may occur during a seismic event. The seam consists of a 1 to 2 inch space between adjacent concrete floor/base mat slabs. The gap is filled with a sheet cork material that was placed in position during the concrete pour. The bottom of the seam is sealed to prevent groundwater intrusion from below by a PVC plastic water stop that bridges the adjacent slabs at a depth of about 60 inches below the top of the slab (42 inches in some areas). A plan view showing the extent of the cork seam is in the attached Figure 1, and a cross-section showing the details of a typical portion of the cork seam is in Figure 2.

During the TMI-2 accident in 1979, the cork seam was immersed in contaminated accident water in the Auxiliary Building's Seal Injection Valve Room (SIVR), leaving the cork saturated and contaminated with radioactive material. In the years since the accident, attempts to contain the contamination have not been fully successful. In addition, the contamination has been spreading in both directions from the SIVR along the cork seam. The spread of contamination has been exacerbated by significant in-leakage of rain water in several areas of the buildings containing the cork seam. As rain water entered through various leakage pathways, it would collect in low areas, enter into the cork filled joints, and in some areas flow over the top of the contaminated joint. This caused migration of the radioactive contamination along the cork-filled joint into previously uncontaminated areas. In some areas, it resulted in the spread of contamination into the concrete surfaces of the floors necessitating considerable effort to monitor, control, and, in some cases, to decontaminate the areas.

As the plant was preparing for entry into Post-Defueling Monitored Storage (PDMS), two apparent safety concerns were identified involving the contaminated cork seam.

The first concern was whether or not there was a potential for contamination in the cork to be leached out through the bottom water stop into the groundwater beneath the base mat, thus creating an environmental release of radioactive material. A study of the hydrology of the site was undertaken to determine the significance of this environmental concern. After considerable study, it was concluded that the hydrology and geology of the underlying strata is such that any significant breaches in the cork seam water stops or the water proofing membranes would result in groundwater intrusion into the plant structures. The probability of contaminated water leaking from the cork seam out into the water table is extremely low.

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The second concern was the potential for further spread of radioactive contamination from the cork filled joint into the plant/floor areas that are not frequently surveyed. The spread of contamination would present a potential for personnel contamination during PDMS monitoring activities, and a potential for environmental release if it spread into uncontrolled areas of the plant. A project was undertaken to identify the sources of water intrusion that causes the contamination spread, repair, as practical, the in-leakage pathways, and seal the top of the cork filled joint in such a manner that any remaining in-leakage of rain water or surface water runoff would not infiltrate and leach out of the contaminated cork.

### CURRENT CONDITIONS

Following an extensive inspection of the buildings, it was determined that the primary sources of water intrusion into the cork seam involved rain water leaking in through roof flashings, the vertical construction joints between adjacent structures, and the horizontal joint between the Reactor Building (RB) wall and the concrete slab at grade level around the outside areas of the RB.

The vertical joint between the Fuel Handling Building (FHB) and the RB at the southwest corner of the FHB was badly deteriorated and the bond between the PVC water stop and the stainless steel vertical water stop had broken. The poor condition of this joint allowed rain water to seep through into the annulus area and directly onto the surface of the cork seam. This water would then flow through the cork seam in the annulus and out to the SIVR and become contaminated. The joint was repaired by insertion of a compressible polyurethane sheet material from elevation 305' to 345', and covering the lower portion with new flashing. The upper areas were re-caulked and a water drainage channel was installed to allow water leakage from above to drain to the outside rather than into the building.

Water was entering the corridor that runs from the M-20 area to the FHB annulus. The corridor roof consists of a concrete slab that abuts the RB wall at elevation 305'. The joint between this slab and the RB wall was leaking and there were cracks in the slab that may have contributed to some in-leakage. The cracks and the joint were sealed by injection with an expandable polyurethane foam sealant, and the construction joint was covered with a built-up flashing arrangement.

Similarly, the joint between the RB wall and the M-20 area cover slab (at elevation 305' between the RB and the north wall of the Turbine Building) was leaking in some places. This joint was sealed by injection with an expandable polyurethane foam material. In addition, the metal flood covers over the RB wall buttresses were resealed. In one case the flood cover was removed, spalled concrete on the seating surface was repaired, and the cover was reinstalled with new attachment bolts.

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Water was leaking into the M-20 area through the vertical and horizontal construction joints between the RB and the RB Equipment Hatch Building, and possibly through cracks in the concrete roof of the Equipment Hatch Building. These areas were repaired using a similar technique of injection of a foam sealant.

The roof over the RB Personnel Hatch and the Hot Instrument Shop (Control Building-East) was deteriorated. The built-up roof membrane was removed, cracks in the concrete slab were repaired by foam injection, and the roof drains were cleared of debris to promote proper run-off and drainage from this area. In addition, the joints between the roof slab at elevation 342' and adjoining vertical walls were sealed by foam injection and roof flashing was replaced where appropriate.

The repairs have significantly reduced the water intrusion into the cork filled joint, and, in some areas, the in-leakage has been totally eliminated. There are some areas where the vertical building joints extend below grade and are not easily accessible and still contribute to some rain and surface water intrusion. For example, the joint where the Air Intake Tunnel adjoins the Service Building still leaks during periods of heavy rain, and it appears as though further repairs may require tearing out sections of the Unit 1/Unit 2 corridor floor to gain access. There are no plans at this time to pursue further repairs of this nature as we believe that the in-leakage has been reduced to manageable levels. To date, about 425 gallons of water has been pumped from the cork seam and was transferred to the building sump for processing.

Modifications have been made to the cork seam to allow periodic monitoring of the water levels in the joint, to permit periodic water removal, and to prevent water and contamination migration within the cork filled joint. Figure 1 shows the locations where the cork seam was penetrated and modifications performed. At locations S-2, S-6, S-7, S-8, and S-9, 1 inch diameter holes were drilled into the cork seam to a depth of about 1 inch above the PVC water stop. A perforated tube was inserted into these monitoring holes and acts much like a conventional well-point in providing a means of pumping accumulated water out of the seam in the vicinity. Also, the monitor pipes have been fitted with bubbler devices that allow measuring of the water level in the holes.

At locations S-1, S-3, S-4, S-5, and S-10, a 4 inch diameter hole was core bored to penetrate the cork and the adjacent concrete slab on both sides of the seam. These holes extend down to the surface of the PVC water stop. When these holes were drilled, the bottom was carefully probed with a blunt instrument to verify that the hole had actually reached the water stop and to verify that the water stop had not been breached and the material was still pliable. Where possible, the water stop was visually inspected. The hole was then filled with a moisture activated expandable polyurethane foam material that will bond well with both the concrete and the water stop material. These locations serve as dams that will block water migration within the cork seam.

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### CONTINUING ACTIVITIES

To prevent any additional spread of contamination from the cork seam in the future, work is presently in progress to install a seal over the top of the cork filled joint. The work involved excavating about 3 inches of cork from the top of the joint along all accessible areas of the full length of the seam. The concrete edges will be surface prepped and primed where required, an open cell polyurethane foam backer bar will be packed into the joint, and the top 1 inch of the joint will be filled with a pourable polysulfide sealant. The materials chosen for this modification are expected to provide a very tight bond with the concrete and provide a good pliable contamination barrier over the surface of the cork seam. The installation of this modification is expected to be complete by the July 1994.

The monitoring holes will remain intact after installation of the top seal described above. This will permit continued monitoring and sampling of the water that may enter the seam and removal for processing as required. A program is in place for continued monitoring of the water level in the cork seam by the PDMS Staff. If water levels begin to increase, the water will be pumped out for processing as needed.

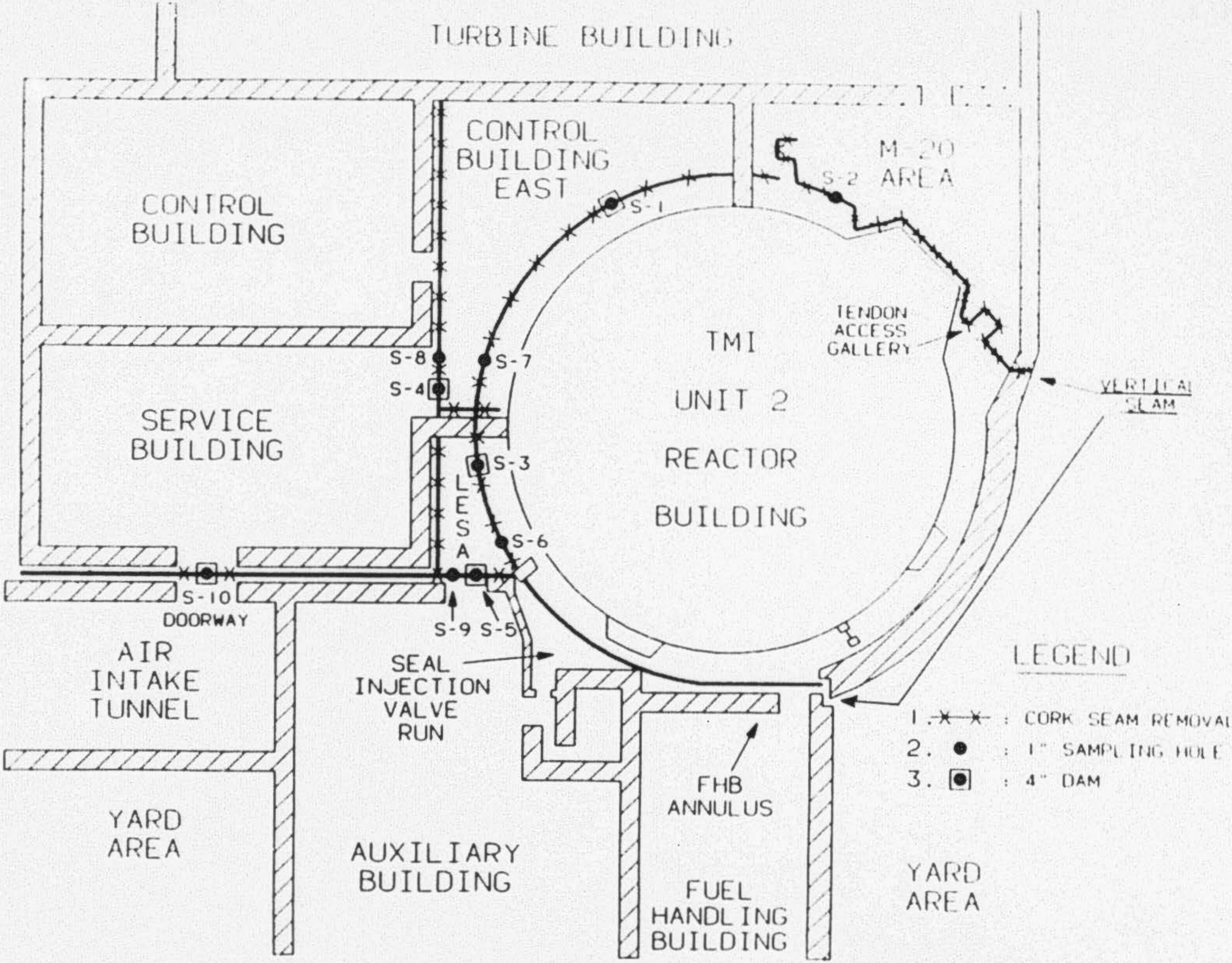
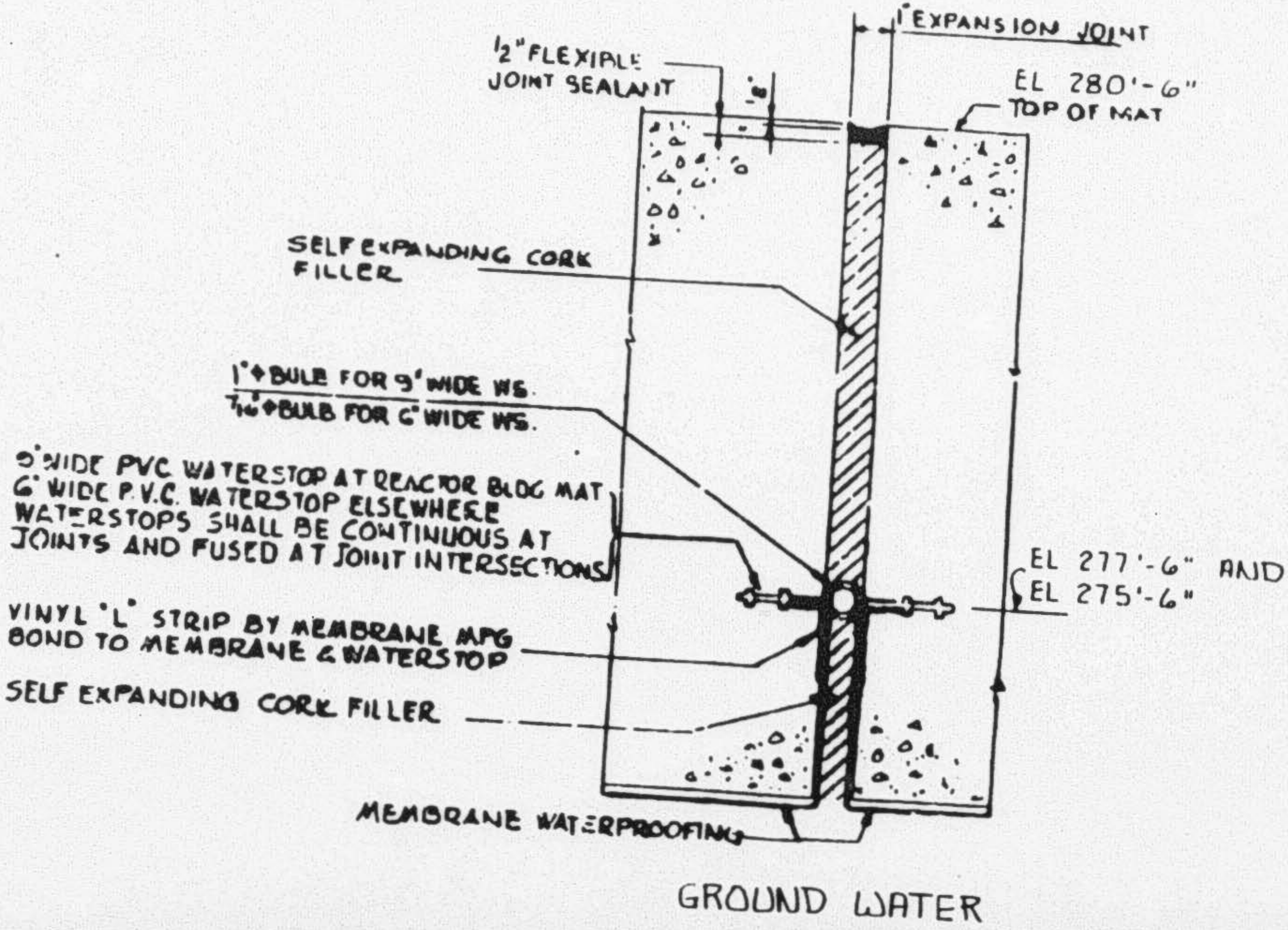



FIG 1: GENERAL ARRANGEMENT OF THE CORK SEAM AREA

FIGURE 2



1" EXPANSION JOINT
1/2" FLEXIBLE JOINT SEALANT
EL 280'-6" TOP OF MAT
SELF EXPANDING CORK FILLER
1" ϕ BULB FOR 9" WIDE WS.
7/16" ϕ BULB FOR 6" WIDE WS.
9" WIDE PVC WATERSTOP AT REACTOR BLDG MAT
6" WIDE P.V.C. WATERSTOP ELSEWHERE
WATERSTOPS SHALL BE CONTINUOUS AT
JOINTS AND FUSED AT JOINT INTERSECTIONS
EL 277'-6" AND
EL 275'-6"
VINYL "L" STRIP BY MEMBRANE MFG
BOND TO MEMBRANE & WATERSTOP
SELF EXPANDING CORK FILLER
MEMBRANE WATERPROOFING
GROUND WATER