NRC FORM 195 (2-76)

U.S. NUCLEAR REGULATORY COMMISSION

DOCKET NUMBER 50-289

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R. W. Reid	Metropolitan Edison Company Reading, Pa. J. G. Herbein	6/3/77
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PLANT NAME:

Three Mile Island Unit No. 1

RJL

ENCLOSURE

Consists of additional information pertaining to applicant's report entitled "Reactor Containment Building Ring Girder Surveillance Test Two Years After S.I.T."..... (11-P)

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NRC FORM 195 (2-76)

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METROPOLITAN EDISON COMPANY

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June 3, 1977
GQL 0771

REGULATORY DOCKET FILE COPY

Director of Nuclear Reactor Regulation
Attn: R. W. Reid, Chief
Operating Reactors Branch No. 4
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289

Enclosed please find an original and 39 copies of additional information pertaining to our report entitled "Reactor Containment Building Ring Girder Surveillance Test Two Years After S.I.T." requested by your letter of May 3, 1977. We trust this submittal satisfies your needs while completing the review of our report.

Sincerely,

J. G. Herbein
Vice President

JGH:JMC:rk
Enclosure

1469 072

7715800

Three Mile Island Nuclear Station
Unit 1
Reactor Containment Building
Ring Girder Surveillance

Ref: USNRC Letter May 3, 1977
Request for Additional Information

QUESTION

1. Figure 3 of the referenced report shows areas where the ring girder "facing" has broken away. Describe the function of the "facing". It is not clear whether it is part of the structural concrete or a fascia. If the "facing" is not structural, provide assurance that eventual cracks can be uncovered during visual inspection. If the "facing" is structural address the effect of the spalling on the structural integrity of the ring girder. Indicate the depth and area of the broken away "facing".

RESPONSE

The "facing" is a surface patch on the outside vertical face of the upper area of the Reactor Containment Building Ring Girder.

There is evidence of surface cracking and/or breaking away of "facing" (scaling) in the region designated as A in Sketch #1 around the entire circumference of the ring girder. The scaling is more prevalent around the North half of the structure than the South half. An examination of the scaled material indicates that two to four layers of finishing mortar has been applied in the area.

A visual inspection of a substantial region of the ring girder surface has been conducted using the nomenclature of ACI Committee 201 Report "Guide for making a Condition Survey of Concrete in Service". The surface cracking of the vertical surface can be described as pattern cracking and does not extend beyond the patching material. The condition of the surface which was exposed by breaking away of material can be described as one of severe scaling with encrustations.

With regard to the function of the "facing", the construction drawings of this area and the FSAR indicate a minimum cover of 2" for reinforcement. The scaling may have reduced the actual cover to less than specified. However, exposed reinforcing bars or rust stains which could be attributed to reinforcement corrosion in either the scaled or cracked areas has not been observed. Any significant corrosion of the reinforcement would be accompanied by increased scaling and discoloration which would be easily detectable. A review of the design calculations indicates that the vertical and circumferential reinforcing near the surface of the affected region is not required for satisfactory structural performance. It serves as minimum reinforcement for shrinkage and temperature.

In any event the surface condition around the ring girder circumference does not reduce the margin of safety for any design basis load combination. The condition is a problem of appearance rather than structural adequacy.

QUESTION

2. In Table 4, Note 4, it is indicated that small cavities were found in the vicinity of tendon bearing plates 149 and 225. Describe these cavities. Indicate their location with respect to the tendon in a sketch. Present a discussion of their effect on the margin of safety and present a suggested method of repair.

RESPONSE

The reported cavities are approximately 1" in diameter, 1" deep and located as illustrated in Sketch #2. They represent an acceptable as-built condition since they do not extend into the bearing area and do not degrade the structural integrity of the containment. Therefore, corrective measures are not required. However, they should be treated in the same manner as the other voids.

QUESTION

3. Figures 6 thru 12 present sketches of seven voids which were found around the dome tendon bearing plates.

   a. Explain why these voids were not discovered during previous inspections.

RESPONSE

It nas been surmised that the voids were covered by lens of concrete (see Sketch #1) which resulted in their being undetected during previous inspections. The use of a reciprocating power wire brush (needle gun) to clean off the surface of bearing plates prior to painting apparently

broke the covering lens and exposed the voids. The voids were reported the next regular surveillance report.

QUESTION 3 (CONTINUED)

b) Outline the procedure by which the effect of the voids on the structural integrity has been evaluated. Address the fact that the voids will act as stress raisers and therefore may generate future cracks. Discuss environmental factors that may facilitate local damage. In light of these concerns, address the effects on the original factor of safety of the design. Discuss in detail the approach used to predict losses in tendon force.

RESPONSE

Section 1.0 of Addendum 1 to "Report on Containment Building Ring Girder Construction and Repair" states the following regarding prestressing and structural integrity testing.

"Initial prestressing and structural integrity test pressure place the ring girder under the most severe load conditions normally expected and therefore will provide clear indication of the effects of repair on the Ring Girder behavior."

Initial prestressing stressed the tendons to 80% of the guaranteed ultimate tensile strength(GUTS) prior to lock off at 70% of GUTS. During the structural integrity test (SIT) the internal pressure of the Containment was raised to 63.3 psig. All the tendons have experienced initial prestressing and SIT loads with no signs of structural distress.

RESPONSE (continued)

The TMI Final Safety Anaysis Report *(Ref. 1) states that the calculated ratio of allowable to actual bearing stress is 1.08 at 70% of GUTS (1394 KIPS Tendon Force). Due to predicted losses the tendon force is approximately 1260 KIPS. *(Ref. 2). Considering the loss in bearing area (approximately 4 sq. inches for void near tendon bearing plate D-115) the ratio of the allowable to actual bearing stress was calculated to be 1.18. This indicated a 10% increase in the factor of safety against exceeding allowable stresses.

It should be noted that this factor of Safety was based on the design concrete strength of 5000 psi. The inplace concrete strength is higher (6590 psi based on 90 day cylinder tests). The Factor of Safety for bearing for tendon bearing plate D 141 (loss of 6 sq.inches bearing area and considering the present predicted tendon force) has been calculated to be 1.21 using design concrete strength. This is 13% higher than the acceptance criteria of 1.08. Considering the actual inplace concrete strength of 6590 psi the Factor of Safety is 1.59 which represents an increase of 51% over the 1.08.

TMI Surveillance Test No. 1301-9.1 titled "Reactor Building Structural Integrity Tendon Surveillance Program" dated October 74 indicates the predicted reduction in tendon force due to long term losses. The first Tendon Surveillance test Report, GAI 1880, indicated close agreement between measured and predicted Tendon Forces. The procedure for computation of Tendon force is discussed in the TMI FSAR.

1469 077

Ref. 1 "Concrete Bearing", TMI Nuclear Station Unit 1 FSAR Docket No. 50-289 Appendix 5B, Part B. Section 8.1, Metropolitan Edison Company.

Ref. 2 Data Sheet 6 Tendon Surveillance Test one year after SIT. GAI Report No. 1880.

RESPONSE (continued)

Although the voids may act as stress raisers the strength of the concrete is continuing to increase and the tendon force is decreasing. The possibility of voids producing further cracks is unlikely. Inspection of void at tendon D 115 over an 18 month period indicated no detectable change in its conditions.

With reference to environmental factors the thermal cycling which has produced the scaling discussed in response to Question 1 could have influenced the cracking at the voids. However, there does not appear to be any correlation between the previously reported cracks near the tendon bearing plates and the presence of voids. There are minor cracks at the Southwest ends of tendon D 115 and D 112 which also have voids while the remaining of the tendon bearing areas with voids are free of cracks. Other tendon bearing areas with cracks do not show signs of voids and none is likely to occur due to environmental or other factors.

Considering the above discussions related to the evaluation of the effects of voids the factor of Safety against exceeding allowable stresses has improved with time.

QUESTION 3

c. Present the acceptance criteria used in the evaluation.

RESPONSE

Acceptance criteria is as discussed in paragraph 2, page 5.

QUESTION 3

d. Provide a timetable for the repair of voids. Outline the repair procedure and discuss the impact of any delay in the repair schedule.

RESPONSE

It is presently planned to repair the voids by the end of the 1978 Refueling Outage. The structure is responding satisfactorily with the voids and there is little likelihood of environmental damage in either the short or long term. Since the voids are not a nuclear safety related problem, there should be no impact if any delay in the repair schedule occurs.

The procedure for repair is as detailed below:

METHOD OF REPAIR

MATERIAL

The void should be repaired with a nonmetallic, nonshrink, high strength grout such as one of the following:

a. U. S. Grout Corporation, Five Star Grout.

b. Sauereisen Cements Company, Sauereisan F-100 Level Fill Grout.

c. Master Builders, Embeco 713 Grout.

AREA PREPARATION

The void area must be prepared for repair as follows and no repair work should commence until all requirements for successful grouting have been satisfied:

a. Clean the interior of the void to provide a firm rough surface, free of dust, dirt, oil, grease and paint.

b. The area to be grouted must be saturated with water four hours prior to placement of the grout.

c. Any surface water in the repair area must be removed prior to grout placement.

FORMS

Forms should be constructed of coated wood or metal and should be firmly anchored. They should be of sufficient strength to keep the grout in place and should be leak proof and of sufficient height to contain a "head" of grout.

MIXING

All mixing must be performed in accordance with the published specifications provided by the grout manufacturer to provide a flowable mix. Sand, gravel or other additives must not be used.

INSTALLATION

The grout is to be poured into the form from only one side to avoid entrapment of air. Grout is to be placed in a continuous operation to preclude separation and is to be worked into place with suitable tools to ensure that the space is completely filled and is free of air pockets or voids. Temperature of both grout and concrete must be within the range specified by the grout manufacturer.

CURING

Curing must be accomplished in accordance with the published specifications of the grout manufacturer. The "pouring spout" must be removed after initial set but prior to final curing.

TESTING

Cube specimens should be made and tested in accordance with ASTM C 109. A total of 6 specimens will be tested: 3 at seven days and 3 at fourteen days. Documentation of results will be retained at TMI.

ALTERNATE INSTALLATION

Variations may be made in the repair procedure to allow the grout to be "dry packed" in accordance with the published specificatiors of the grout manufacturer.

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
READING, PA.

CLIENT: MET. Ed

PROJECT: TMI-1

FILING CODE

W.O. 04 4692-104 | PAGE 1 OF 1

SYSTEM: CONTAINMENT RING GIRDER

ORIGINATOR: PAGES

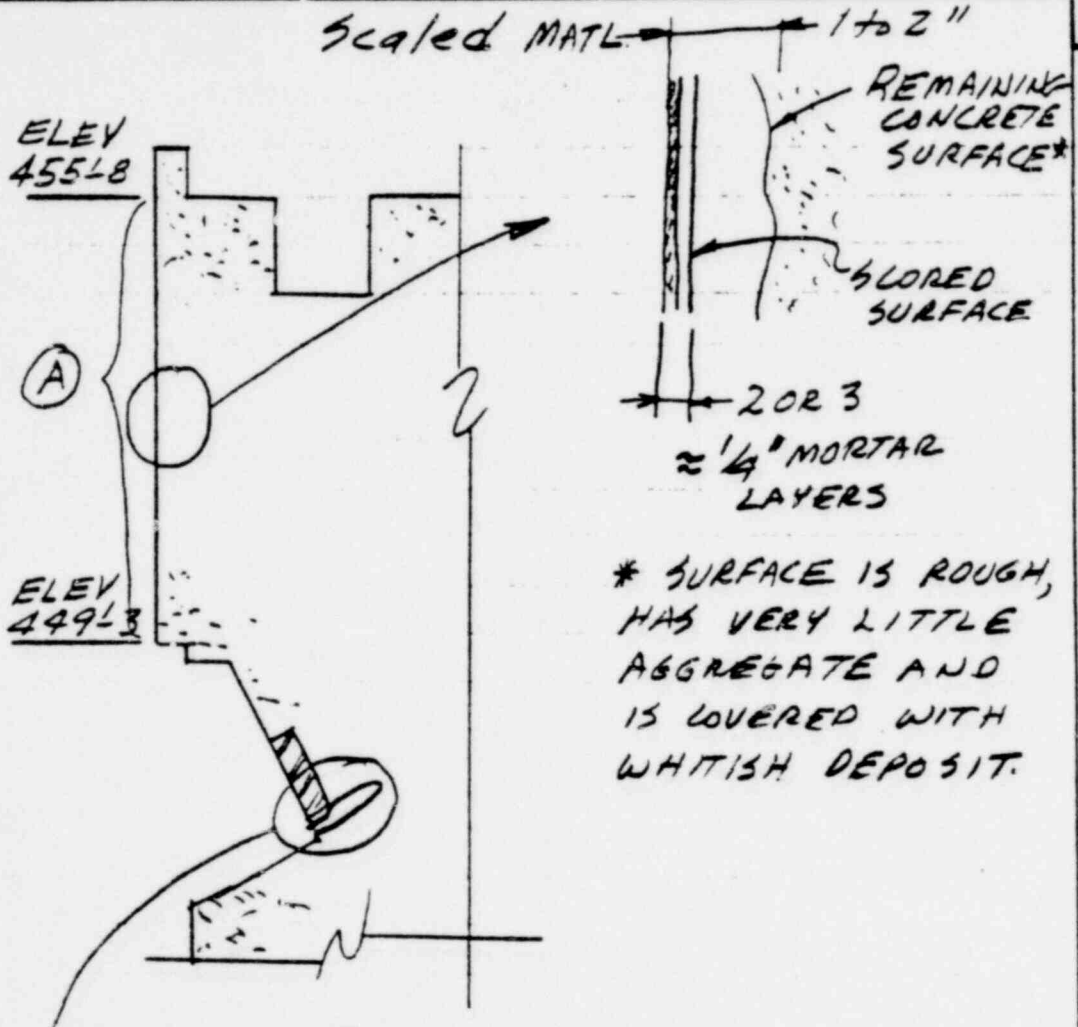
DATE: 5/19/77

CALCULATION FOR: SKETCH #1

REVIEWER

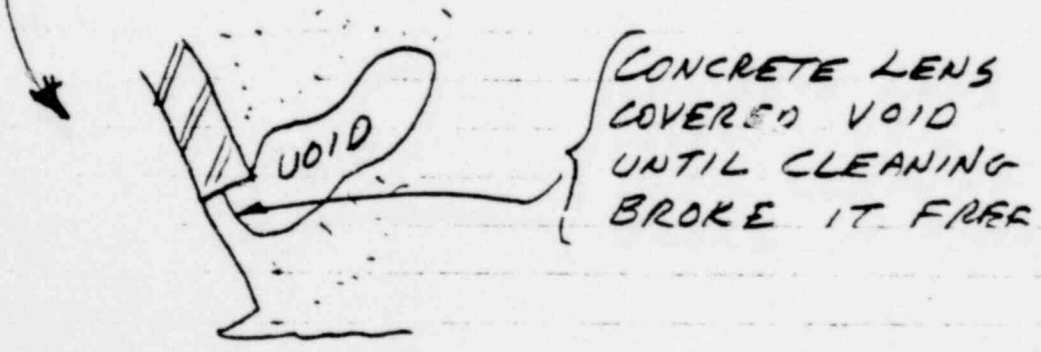
DATE

RESULTS



* SURFACE IS ROUGH, HAS VERY LITTLE AGGREGATE AND IS COVERED WITH WHITISH DEPOSIT.

TYPICAL RING GIRDER SECTION (NOT TO SCALE)



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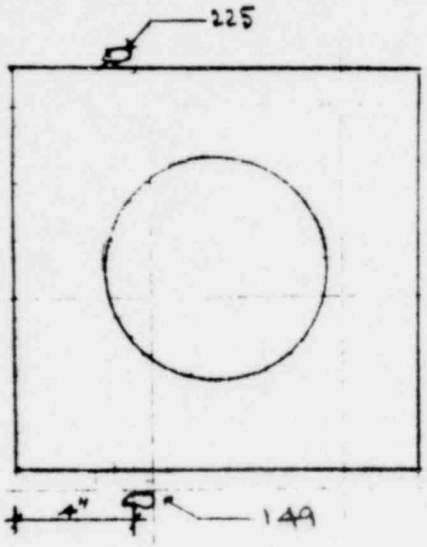

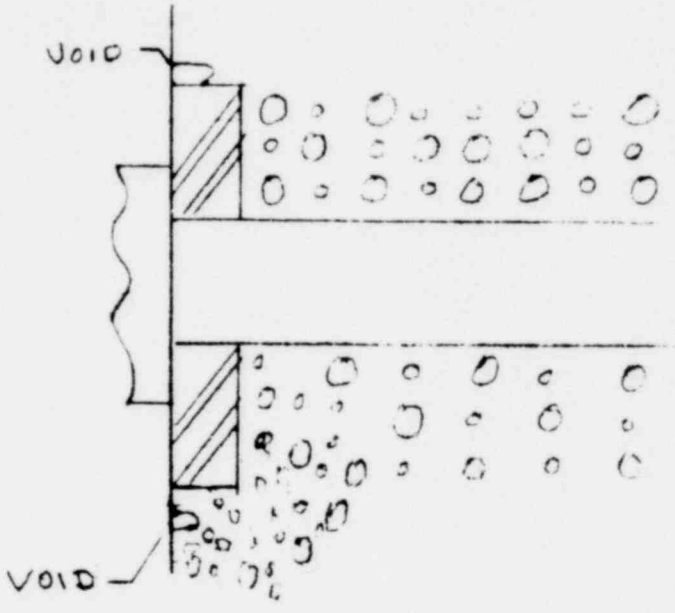

TENDON BEARING PLATE	149	225
SECTIONAL AREA	0.8 m^2	0.8 m^2
EST VOLUME	1.00 m^3	1.00 m^3

SKETCH # 2

TENDON BEARING PLATES

149 & 225

1469 083