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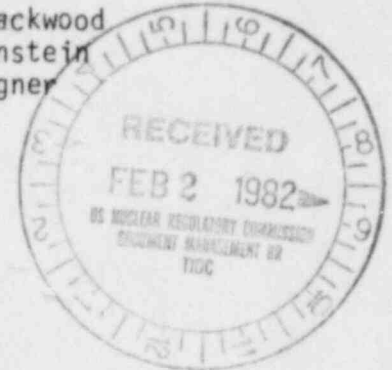
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Docket No. 50-289

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Mr. Henry D. Hukill, Vice
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Dear Mr. Hukill:

We have reviewed your responses to IE Bulletin 80-11 regarding masonry walls, and find that additional information is needed for us to complete our review. Therefore, we ask that you provide the information requested in the enclosure to this letter within 45 days of its receipt.

Since this information request is for specific TMI-1 related information, fewer than ten respondents are affected; therefore OMB clearance is not required under P.L. 96-511

If you have any questions on this subject, please contact your NRC Project Manager.

Sincerely,

PERSONAL SIGNED BY
JOHN F. STOLZ

John F. Stolz, Chief
Operating Reactors Branch #4
Division of Licensing

Enclosure:
Request for Additional
Information

cc w/enclosure:
See next 3 pages

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DATE	1/22/82	1/22/82	1/22/82			

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ENCLOSURE

ADDITIONAL INFORMATION REQUESTED FROM THE LICENSEE

To facilitate completion of the review on this topic for TMI Unit 1, the Licensee should address the following:

1. The Licensee used a static analysis based on multiplying the mass of the structure by the peak amplified response spectra (ARS) instead of a dynamic seismic analysis. To account for possible multi-mode effects, an amplification factor of 1.05 was used to obtain the equivalent static load. The Standard Review Plan (SRP) [9] accepts an equivalent static load method if the system is shown to be realistically represented by a simple model and the method gives conservative results. Furthermore, it suggests that a factor of 1.5 be applied to the peak ARS of the applicable floor response spectra. In view of this, it is suggested that the Licensee provide information to justify use of an amplification factor of 1.05.
2. Appendix 7.2 of Reference 3 provided a summary of stresses, in which load combination included dead load, pipe reactions, and seismic loads. The thermal effect and wind load were not accounted for. In Reference 2, the Licensee indicated that the thermal effect is insignificant, but did not justify this conclusion. The Licensee should elaborate on this point and also indicate if wind load was included in the analysis.
3. In Reference 2, the Licensee used the single wythe assumption (for out-of-plane loading) for multiple wythe walls. The Licensee should demonstrate that this assumption will result in a conservative evaluation.
4. With regard to stresses resulting from equipment, a static analysis was used by multiplying the weight of the equipment by the peak acceleration of the response spectrum of the corresponding floor. The Licensee should clarify whether a multiplication factor was used to obtain the equivalent static load or, if not, explain why.

5. With regard to the seismic analysis, the Licensee indicated that the vertical component of the motion was not included in the analysis because the positive effect of the dead load on bed joint stresses was not included in the evaluation criteria. Although the positive effect is not easily determined, it is suggested that the Licensee attempt to identify this positive effect (from test data or literature) and include it in the analysis or neglect it altogether, which will result in a conservative evaluation. However, it does not seem justifiable to neglect the vertical component of the motion.
6. The Licensee should describe how the interstory drift (both in-plane and out-of-plane) during a seismic event and the loads from piping and/or equipment attached to the masonry walls were accounted for. Both the local and global effects of piping and/or equipment attached to the masonry walls should be described and examples of the analysis provided.
7. In Section 6.1.2 of Enclosure 3 [2], ranges of $\pm 25\%$ and $\pm 20\%$ were given for the modulus of elasticity of ungrouted and grouted walls, respectively, to account for uncertainties in evaluating the frequency of the walls. The Licensee stated, "if the frequency of the walls falls on the low frequency side of the amplified region of the response spectrum adequate provisions are included to ensure that the determination of the stress in the wall is conservative." The Licensee should define and discuss these "adequate provisions."
8. With regard to the in-plane effects, the strength of the strut corresponding to a strain at cracking is given in expression (1) of Section 6.5 of Enclosure 3 [2]. The Licensee should provide a complete derivation of this expression and discuss how this expression relates to the permissible strain levels of unconfined and confined walls.
9. The Licensee should discuss and justify the boundary conditions used in the analysis of the 14 walls mentioned in Reference 3.
10. The Licensee plans to provide steel brackets to reinforce the end spans of the north and south walls of the elevator shaft. The Licensee should evaluate the out-of-plane drift effects that would result from these brackets.
11. With reference to the in-plane effects for factored loads (Section 6.5 of Enclosure 3 [2]), a factor of 1.67 was introduced to the allowable in-plane strain. The Licensee should provide the technical basis for this factor.
12. With regard to the "Energy Balance Technique" and the "Arching Theory" [2], the Licensee should not resort to these approaches, if possible.

13. The modulus of elasticity for grouted or solid walls was varied from $800 f_m'$ to $1200 f_m'$. ACI 531-79 [6] recommends a maximum of $1000 f_m'$. If the Licensee selects $1200 f_m'$ in the analysis, an explanation should be provided.
14. With regard to the collar joint strength, the Licensee used the same test value that was used for the Trojan plant. The Licensee should discuss the applicability of this test to the TMI Unit 1 masonry walls. In Reference 3, the Licensee proposed that the collar joints of multiple wythe block walls be filled with non-shrink Portland cement grout. The Licensee should provide technical data to support the use of this grout and indicate how this repair will strengthen the collar joint. Furthermore, the Licensee should clarify whether the auxiliary building has any multiple wythe block walls and, if not, explain why this proposed modification was introduced.
15. With regard to shear for reinforced masonry, the Licensee introduced test results on shear strength of reinforced masonry. Specifically, Figure 2 of Enclosure 3 [2] presented test data for various percentages of reinforcement. For the case in which there is more than 0.3% horizontal reinforcement, there is only one test value for $M/VD = 1.0$ and there are two test values for $M/VD = 0.5$. For the case in which there is less than 0.3% horizontal reinforcement, there are no test data for $M/VD = 1.0$. The data presented do not appear to be sufficient to justify use of these values. The Licensee should discuss the technical basis for the applicability of these tests to the masonry walls at TMI Unit 1 with respect to the mortar type, boundary conditions, and nature of the loads (i.e., dynamic, static) and should identify and provide the source of these tests.
16. With regard to shear for unreinforced masonry, a factor of 1.5 was introduced for allowable shear for factored loads. SEB criteria [4] suggest a factor of 1.3. The Licensee should provide any literature or test data to support the use of a factor of 1.5.
17. With regard to allowable tensile stresses normal to bed joints, SEB criteria [4] suggest a factor of 1.3 for factored loads. The Licensee should discuss and justify the use of a factor of 1.5. The Licensee should also discuss the applicability of those tests mentioned in Section 5.1.5 of Enclosure 3 [2] to the TMI Unit 1 masonry walls.
18. With regard to bond stress, the Licensee should discuss and justify an increase of 33-1/3% for factored loads.
19. Indicate the intended action to evaluate wall AB-14.
20. Provide the schedule for the proposed modifications specified in Reference 3.

REFERENCES

1. IE Bulletin 80-11
"Masonry Wall Design"
NRC, May 8, 1980
2. H. D. Hukill (Director, TMI Unit 1, Metropolitan Edison Company)
Letter with enclosures to B. H. Grier (NRC)
November 17, 1980
3. Metropolitan Edison Company
"Three Mile Island Unit 1 - Reevaluation of Safety-related Concrete
Masonry Walls, NRC IE Bulletin 80-11"
Topical Report No. 001, Rev. 0
July 14, 1981
4. Standard Review Plan, Section 3.8.4, Appendix A
"Interim Criteria for Safety-Related Masonry Wall Evaluation"
NRC, July 1981
5. Uniform Building Code
International Conference of Building Officials, 1979
6. ACI 531-79 and Commentary ACI 531-R-79
"Building Code Requirements for Concrete Masonry Structures"
American Concrete Institute, 1979
7. ATC 3-06
"Tentative Provisions for the Development of Seismic Regulations for
Buildings"
Applied Technology Council, 1978
8. "Specification for the Design and Construction of Load-Bearing
Concrete Masonry"
National Concrete Masonry Association (NCMA), August 1979
9. Standard Review Plan, Section 3.7.2
"Seismic System Analysis"
NRC, July 1981