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July 30, 1984
5211-84-2194

Office of Nuclear Reactor Regulation
Attn: J. F. Stolz, Chief
Operating Reactors Branch No. 4
Division of Licensing
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
EFW System Seismic Interaction Questions

In response to your letter of July 24, 1984 and based on a phone conversation between members of our respective staffs on July 26, 1984, enclosed is GPUN's response to four NRC questions on our submittal of July 16, 1984 (5211-84-2160).

Sincerely,

H. D. Hukill
Director, TMI-1

HDH/LWH/MRK/jrg

Enclosure

cc: R. Conte
J. Van Vliet

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EFW System Seismic Interaction

Item 1. Items 1, 2 and 3 of attachment No. 2 of Reference 1 stated that the design code (B31.1) allowable stress limit for the line at operating conditions is not exceeded when the line is subjected to a coincident Safe Shutdown Earthquake (SSE). Quantify allowable stress limit utilized for the piping stress evaluation. In addition, provide information to clarify (1) whether you have included pipe supports in these piping system evaluations and (2) whether the results of these analyses are within the design allowable stress limits for pipe supports. (The allowable stress limits used for the pipe support evaluation also needs to be qualified.)

Response

1a) The piping addressed in Items 1, 2 and 3 of Attachment 2 in GPUN's seismic interaction response was analyzed for an SSE seismic event. The SSE Seismic Stresses were combined with deadweight and pressure stresses as defined in Equation #12 of the B31.1 Code paragraph 104.8. These stresses where compared to the allowable for Equation #12 which is defined as $1.2S_h$.

Typical values for $1.2S_h$ (for ASTM A-106 Grade B material) = 1.2 (15000 psi) = 18000 psi

1b) The pipe supports were evaluated for the piping loads applied to the supports by an SSE seismic event. The supports are within the allowable stresses as defined in GPUN's Response to IEB 79-02 which is covered by GPUN Topical Reports 002 and 003. In addition, support anchor bolts are designed with safety factor of 4 for wedge type anchors and 5 for shell type anchors. Prying action on the support base plates was also considered. The resulting stresses are within the yield strength of the material for pipe supports.

Item 2. Item 4 of Attachment 2 of Reference 1 stated that the Auxiliary Steam Line will not experience large seismic stresses that could cause a breach of the system's pressure boundary. However, last paragraph of Reference 1 stated that the result of the Auxiliary Steam Line piping exceeds the FSAR allowable stress limit. The two statements, taken at face value, seem contradictory. Provide additional information to clarify the above statements and to justify that the Auxiliary Steam Line will remain intact during and after an SSE.

Response

The contradictory nature of the two statement arises from last minute information which was added to the submittal of July 16, 1984, but which did not result in a change in the cover letter. The statement in the second sentence of the last paragraph of the cover letter was to be changed to read:

"We have also reviewed the FSAR allowable stress limits for high energy break locations for piping in the Intermediate Building and find that these limits are in no case exceeded except for the auxiliary steam line (FSAR Appendix 14 A does not include detailed stress analysis for the auxiliary steam line)."

The evaluation of the seismic capacity of the aux steam line up stream of valve AS-V-14 is covered in Section 5.3 of GPUN Calculation No. C-1101-424-5320-019. The approach taken in this calculation is to determine if the building was capable of exciting the piping during a seismic event. As the piping is only supported for deadweight with long threaded rods having pinned ends it is reasonable to assume that during horizontal seismic events the deadweight supports will act as pendulums. The analysis calculated a typical pendulum frequency for the system of between .3613 Hz and .2794 Hz. In addition, the building first natural frequency is 13.16 Hz taken from the response curve for the building. Comparing the two frequencies, it is clear that the building will be incapable of exciting the piping during a horizontal seismic event (i.e. the piping will probably enter into a gentle swinging motion during the event).

Also the threaded rods are spaced in such a manner that the first natural frequency for a typical support span (i.e. 11.25 ft.) is 24.17 Hz for a vertical SSE seismic event. Using this natural frequency the maximum deadweight and SSE seismic stress in the vertical direction is approximately 3300 psi assuming a maximum deadweight stress of 1500 psi.

Based on the above analyses, GPUN has determined that the aux. steam piping stresses that includes SSE seismic stresses will be less than the Equation #12 allowable stress of $1.2S_h$ per B31.1 Code.

As for an HELB analysis of the aux steam line, no such analysis has been performed. However, based on the walkdown of the system the following conclusions can be drawn. Due to the high flexibility of the piping system, the thermal expansion stresses are negligible. The spacing between deadweight supports is such that the maximum deadweight stress will be less than 1500 psi. Therefore, the sum of the primary and secondary stresses is well below the Gaimbusso Criteria of .8 (S_a+S_h).

Item 3. Provide additional information to clarify the statement in Item 5 of Reference 1 that "the piping downstream of COV-14A/B from the Intermediate Building to a point inside the trench of the Turbine Building may be considered to have seismic resistance based on an analysis done in response to IEB 79-14. Provide additional information similar to that requested in question 2, to justify that the subject piping will remain intact during and after an SSE.

Response

The piping downstream of COV 14 A/B from the Intermediate Building to a point inside the Turbine Building will remain intact during and after an SSE. This determination was based on stress analysis performed in response to IEB 79-14 dated December 30, 1982 (5211-82-296).

Attached to this IEB 79-14 response was GPUNC Technical Data Report TDR No. 194, "Final Report to USNRC for IE Bulletin 79-14 Requirements at TMI Unit #1" where page 12 to Appendix I of this TDR lists the piping drawings for the Emergency Feedwater System. Specifically, Isometrics #D-312-625 and D-312-697 and piping drawing E-304-102 show the piping downstream of COV14A/B that runs into the Turbine Building (below the Turbine Building ground floor) that was analyzed as part of the response to IEB-79-14. This analysis provides justification for considering the Seismic SI boundary to be outside the Intermediate Building wall.

Item 4. Provide a detailed discussion to justify the statement that the vent stacks for the main steam safety valves are judged adequate to withstand an SSE.

Response

The evaluation of seismic adequacy of vent stacks for Main Steam Safety/Relief valves is included in GPUN Calculation No. C-1101-424-5320-022. The calculation shows the following results:

	Forces	Moments
Seismic Load (SSE)	2000 lbs.	42,000 ft.-lbs.
Blowdown Load	13000 lbs.	130,000 ft.-lbs.

It is shown that the blowdown loads envelope the seismic (SSE) loads. Since the blowdown loads have been applied during past operational history of TMI-1, there is no doubt that the stacks will withstand the SSE event.

Ref 1: GPUN letter dated July 16, 1984 (5211-84-2160)