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Responds to 780913 ltr requesting info re proposed fire protec & structural design mod. Items 1,2, & 3 of request are answered. Items 4 & 5 were answered in fire protec submittal of 780922. Position P8 answer in future.

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LEON D. WHITE, JR.
VICE PRESIDENT

TELEPHONE
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October 11, 1978

Director of Nuclear Reactor Regulation
Attention: Dennis L. Ziemann, Chief
Operating Reactors Branch No. 2
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Pressure Shielding Steel Diaphragm
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Ziemann:

This letter is in response to your letter dated September 13, 1978 which requested additional information concerning the proposed modifications to Ginna Station. The request covered fire protection and structural design.

Items four and five of the request deal with the fire loading within the turbine building, design of the proposed water curtain, and the protection of exposed structural steel. The fire loading and water curtain questions are answered in our fire protection submittal dated September 22, 1978. Position P8 relating to the fire protection of structural steel will be answered in the near future.

Items 1, 2 and 3 concern the structural design of the Pressure Shielding Steel Diaphragms. Information for these responses was developed by our consultant on this modification, Gilbert Associates.

Item 1:

The turbine building is a steel frame structure and a plane frame model can be used to analyze its seismic response. The dynamic response should be governed by the dominant mode only. When an equivalent static load method is used for this type of plane frame structure, the peak of applicable response without any factor is already a conservative static load. However, for extra conservatism, a factor of 1.5 was applied to the peak of the applicable response spectrum.

The steel corrugated diaphragm used should not affect the seismic response of the frame. The calculated frequency of the diaphragm relative to the steel frame is about 15 cps. Thus, the diaphragm is very stiff relative to the frame, and there is very little amplification of the diaphragm relative to the frame. Furthermore, all the diaphragms are below mid-height of the frame where the actual acceleration value is much lower than that at the top of the frame. The static equivalent load method conservatively assumed the acceleration at the bottom of the frame was as high as that at the top of the frame. To make a qualitative estimate of the hypothetical amplification, we can conservatively assume the fundamental frequency of the frame to be 1 cps, and the input from the frame to the diaphragm to be sinusoidal. The fundamental frequency of a similar Turbine Building on one other project design by our consultant, Gilbert Associates, was calculated to be 0.6 cps.

Since the information on higher modes are not available from this Turbine Building analysis, they are obtained from other sources. The frequency ratios of higher modes relative to the fundamental modes of a cantilever beam model are calculated as 2.8, 4.8, 7, and 9.8 cps. The participation factors are 1.35, 0.65, 0.32, 0.06, and 0.01. Hence, the amplified response of the diaphragm can be conservatively calculated as follows:

Mode	Frequency (cps)	Participation Factor	Mode Shapes	Amplification of Diaphragm at 75% Damping	Response = (3)x(4)x(5)
1	1.	1.35	0.5	1.0	0.68
2	2.8	0.65	1.0	1.04	0.68
3	4.8	0.32	0.5	1.1	0.18
4	7.	0.06	0.5	1.3	0.04
5	9.8	0.01	0.5	1.4	0.01
Root of the Sum of the Squares					0.98

Thus the hypothetically worst response of the diaphragm is 0.98 times the peak of the spectrum value, and design used a factor of 1.5.

The equivalent static load method without the 1.5 factor was used by Gilbert Associates to analyze an unsymmetrical spent fuel pool crane. Due to the conservatism involved, the crane was not qualified by this method. A subsequent response spectrum method using a space frame model was applied to qualify the crane and the reaction force at crane support was reduced by a factor of more than 3. This is only one of the examples used to show the degree of conservatism of the equivalent static load method.

Item 2

All other loading conditions and combinations have been considered in accordance with the requirements of the U.S. NRC Standard Review Plan Section 3.8.4 "Other Seismic Category I Structures" dated 11-24-75, and the applicable combinations are noted in our "Design Criteria for Pressure Shielding Steel Diaphragm in Turbine Building."

Item 3

The new criteria apply to steel diaphragms and all the structural steel framing members of the Turbine Building on column lines 11, 12, and 13 as well as the Diesel Generator Building at the north and the Control Building at the south. Since the diaphragms are only connected to column lines 11, 12 and 13, they will not affect the balance of the turbine building nor can they in any fashion increase the loading conditions to the remainder of the turbine building.

The following is a summary of the actual and allowable stresses in the most critical elements of the structural steel framing supporting the new steel diaphragms. (Note: the actual stresses have been reduced by the 1.6 or 1.7 factors allowed by SRP 3.8.4 II so that they can be compared with the allowable stresses in Part I of the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.")

	Actual Stress	Allowable Stress	% of Allowable used
Top Chord of Roof Truss	9430 psi	21600 psi	43%
Bottom Chord of Roof Truss	6470 psi	6510 psi	99%
Roof Truss Diagonal	9600 psi	9900 psi	97%
Columns - various	-	-	77%
Horizontal Members of Steel Diaphragm	22700 psi	24000 psi	95%

The appropriate loads, loading combinations and acceptance criteria applicable to the remainder of the Turbine Building will be developed as other modifications are proposed as the result of studies of the consequences of crack breaks in the Turbine Building and as a result of the Systematic Evaluation Program.

Please contact us if there are any further questions.

Very truly yours,

L.D. White, Jr.

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