TOLEDO EDISON

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Docket No. 50-346

License No. NPF-3

Serial No. 976

August 19, 1983

Director of Nuclear Reactor Regulation
Attn: Mr. John F. Stolz, Chief
Operating Reactors Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

IE Bulletin No. 80-11, dated May 8, 1980 (Log No. 1-362), requires Toledo Edison to evaluate the structural adequacy of all masonry walls which are in proximity to or have attachments from safety-related piping or equipment such that a wall failure could affect a safety-related system at the Davis-Besse Nuclear Power Station Unit 1.

On June 21-23, 1983 we met with several members of the NRC Staff at the Davis-Besse site to review our previous responses to IE Bulletin No. 80-11 and questions raised by the Staff. That meeting generated some additional Staff requests for additional information which were transmitted by your July 21, 1983 letter (Log No. 1329). Attached is our response to the Staff's request for additional information.

Yours very truly,

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RPC/CLM

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Attachment

cc:
Mr. James G. Keppler
Regional Administrator, Region III

DB-1 NRC Resident Inspector

IE-11
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RESPONSE TO ACTION ITEMS
RESULTING FROM MEETING OF JUNE 21, 22 & 23, 1983
DAVIS-BESSE UNIT 1

1. Provide a summary of walls which have to be qualified by an increase in allowable stresses for OBE load combinations. Indicate actual calculated stresses and allowable stresses. Justify the increase in allowable stresses.

<u>Response:</u>

Five walls were accepted for OBE load combinations using allowable stresses computed by multiplying the working stress allowables by a factor of 1.25. For a summary of these walls, see Table I. Our decision to use an increase factor was based on ACI 531-79 which permits masonry stress due to wind or earthquake to be increased by 1.33. We felt it to be more consistent with our FSAR to use a factor of 1.25 versus 1.33. Our acceptance criteria was developed and finalized prior to the staff's interim criteria. In Table I, we have compared various block wall parameters and stress conditions using factored and unfactored allowable stresses. These factors indicate that there is adequate margin in the design of these walls. The basis for this conclusion is the conservatism in our analytical model and techniques, (i.e., BLOCK WALL computer program). Therefore, we conclude that if the time and resources were expended to perform a more refined analysis that these walls would be acceptable using unfactored allowable stresses. However, it is not cost effective to pursue the refining of these analysis.

2. Clarify and justify the use of I effective/t effective or I uncracked/t uncracked in the calculations of wall No. 2297, where:

I effective = Effective moment of Inertia
t effective = Effective thickness of the section used in the analysis
I uncracked = Uncracked moment of Inertia
t uncracked = Thickness of the uncracked section used in the analysis

<u>Response:</u>

Wall 2297 is a double wythe wall consisting of two eight-inch wythes, separated by two inches of concrete fill. The wall was initially analyzed as two independent eight inch walls, spanning vertically, using the BLOCK WALLS computer program yielding a maximum ductility ratio of 2.07. This indicated the wall was acceptable based on energy balance criteria.

However, this analysis revealed that the steel floor beam to which the top of the wall is attached was overstressed in torsion, thereby requiring a modification. To obtain a more realistic boundary reaction from the wall on the floor beam, for the purpose of designing the modification, the wall was reanalyzed assuming a composite section using the BSAP computer program.

The procedure utilized with the BSAP dynamic run to calculate the natural frequency of the wall is to calculate I effective for the vertical span assuming the applied moment is maximum, in other words, is equal to the yield moment. It follows that t effective is equal to the cube root of I effective. This results in a minimum natural frequency, hence a maximum acceleration. This acceleration is then used as input for the static BSAP run to determine stresses and reactions. Additionally, I effective is assumed as input for the static BSAP run, and at the completion of the run the assumption is checked. For wall 2297, I effective for the static run was assumed equal to I uncracked. At the conclusion of the run, this assumption was checked and found to be valid.

Therefore, the use of I effective, t effective, I uncracked and t uncracked in the calculation for the modification for wall 2297 is justified and correct. The masonry was initially accepted by analyzing the wall as two independent eight inch wythes.

3. Verify that for wall 3447, 3457 and 3467, the only safety system affected by wall failure would be the HVAC duct as assumed in the calculations.

Response:

Further review indicates that the only impacted attachment would be the HVAC duct as assumed in the calculations. This condition is acceptable because the HVAC duct is not nuclear safety related. The note in the calculation states the duct is not safety related, which was misinterpreted during the meeting.

4. Provide the basis for not performing a displacement/operability check for safety systems attached to walls qualified by the ductility values of less than 3.0.

Response:

The methods and acceptance criteria for CMU walls was developed based on the characteristics and properties of the walls and not the characteristics of the attachments. However, it was recognized that it would be necessary to check attached systems for large deflections. Similar attachments are made to concrete and steel structural elements which also experience deflections when loaded. A deflection criteria of L/240, which is common in structural applications, produces a corresponding range in ductility values of 2.7 to 3.3 for 12 inch thick, totally grouted, uniformly loaded, 14 to 18 foot high CMU walls. The majority of walls at Davis-Besse which were accepted by the energy balance technique are twelve inches in thickness and 14 to 18 feet in height.

The majority of CMU walls at Davis-Besse which were accepted by the energy balance technique were analyzed using the BLOCK WALLS computer program. The BLOCK WALLS computer program conservatively over predicts wall deflections. As an indication of this conservatism, see Table II for a comparison of deflections calculated for eleven walls using BSAP computer program versus BLOCK WALLS computer program. If additional walls, which were initially accepted by the energy balance technique using "BLOCK WALLS", were reanalyzed using BSAP, similar results are anticipated. Based on this conservatism, a ductility criteria is more appropriate for walls accepted by the BLOCK WALLS computer program than a deflection criteria.

Based on the above statements, it is our engineering judgement that a calculated ductility of 3 is an acceptable lower limit for checking systems attached to walls for deflections.

5. Justify the assumption of fixed boundary condition in some situations by examining a typical connection detail where this assumption is used. Assess the impact of joint flexibility on calculated results.

Response:

A typical fixed connection as utilized at Davis-Besse was examined for effects on natural frequency/wall acceleration resulting from assuming a reduction in the rigidity of the connection. The connections for cantilever beam analysis were assumed fixed for simplicity of analysis. For this analysis, only a frequency shift can possibly cause higher wall stresses. A further review of these walls based on appropriate spring constants for the components of the connections, shows that lower frequencies resulting from the increase in flexibility, do not result in stresses within the walls that are higher than the allowable stresses. The frequencies of these walls correspond to the peaks of the modified floor response curves or are significantly above 33 cps. Seven CMU walls out of this group have frequencies between approximately 17 and 33 cps, and are therefore potentially affected by a frequency shift. A review of masonry and rebar stresses shows an acceleration shift would not affect the acceptance of these walls. Additionally, all seven of these walls have two or more supported boundaries, only one of which was considered in the BLOCK WALLS computer program calculations and is conservative. However, consideration of the additional boundaries would yield higher frequencies and, corresponding lower accelerations. Therefore, we conclude that an increase in joint flexibility would not affect the acceptance of any CMU walls at Davis-Besse where a fixed boundary condition was assumed.

TABLE I

SUMMARY OF WALLS PASSING BY USING INCREASED ALLOWABLE STRESSES FOR OBE

Wall No.	Span	Actual Tensile Steel Stress (KSI)	Increased Allow. Steel Stress (KSI)	Unfactured Allow. Steel Stress (KSI)	Factor of Safety		Actual Masonry Compressive Stresses		Increased Allow. Masonry Stresses		Unfactored Allow. Masonry Stresses		Masonry Interaction	
					(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	with increased allow.	without increased allow.
3016	Vert.	22.5	25	20	1.78	2.0	0.373	0.013	0.625	0.349	0.500	0.279	0.63	0.79
3198	Horiz.	34.34	37.5	30	1.89	2.17	0.202	0.004	0.625	0.375	0.500	0.300	0.33	0.42
5137	Horiz.	37.08	37.5	30	1.75	2.17	0.344	0.006	0.625	0.340	0.500	0.272	0.57	0.71
5287	Vert.	7.5	25	20	5.33	2.0	0.174	0.187	0.562	0.335	0.450	0.268	0.87	1.08
4026	Vert.	22.8	25	20	1.75	2.0	0.377	0.107	0.625	0.338	0.500	0.270	0.92	1.15

(1) = Actual
(2) = Minimum theoretical
(3) = Bending (KSI)
(4) = Axial (KSI)
(5) = Bending (KSI)
(6) = Axial (KSI)
(7) = Bending (KSI)
(8) = Axial (KSI)

TABLE II

Comparison of Deflections Calculated Using
BSAP and BLOCK WALLS Computer Programs

Wall No.	Thickness (in.)	H/W	BSAP SSE Deflections (in.)	BLOCK WALLS Span (in.)	BLOCK WALLS SSE Deflections (in.)
1068	8	0.76	0.092	Vert.	0.821
306D	12	1.10	0.034	Vert.	0.515
3247	12 (P)	1.49	0.313	Vert.	0.408
3357	12	0.64	0.221	Vert.	0.702
4046	12	1.85	0.153	Vert.	2.749
			(OBE)		(OBE)
5137	4	2.32	0.291	Horz.	1.922
			(OBE)		(OBE)
3287	12	2.10	0.185	Horz.	0.427
4036	12	1.38	0.550	Vert.	12.58
5207	8	0.74	0.040	Vert.	1.120
3237	12	1.57	0.151	Vert.	0.336
4026	12	1.62	0.212	Horz.	1.363

(P) = Partially grouted