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W3F1-2002-0071

July 31, 2002

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Waterford Steam Electric Station, Unit 3
Docket No. 50-382
Supplement to Amendment Request
Realignment of Refueling Water Storage Pool (RWSP) Boundary Isolation Valves to RWSP Purification System

REFERENCES:
1. Entergy letter dated April 2, 2001, "Request for Review and Approval of Design Basis Change Regarding Realignment of Refueling Water Storage Pool (RWSP) Boundary Isolation Valves to RWSP Purification System" (W3F1-2001-0007)
2. Entergy letter dated September 24, 2001, "Response to Request for Additional Information Regarding Realignment of Refueling Water Storage Pool (RWSP) Boundary Isolation Valves to RWSP Purification System" (W3F1-2001-0087)
3. Entergy letter dated February 27, 2002, "Response to Request for Additional Information Regarding Realignment of Refueling Water Storage Pool (RWSP) Boundary Isolation Valves to RWSP Purification System" (W3F1-2002-0018)

Dear Sir or Madam:

By letter (reference 1), Entergy Operations, Inc. (Entergy) proposed a change to the Waterford Steam Electric Station, Unit 3 (Waterford 3) design basis as described in the Final Safety Analysis Report for which NRC approval is required. The change concerns design requirements for the alignment of the refueling water storage pool (RWSP) boundary isolation valves to the RWSP purification system.

Entergy and members of your staff have held calls to discuss the basis for seismic qualification relative to the requested change. During a December 19, 2001 call, Entergy committed to perform seismic analysis of a portion of the system and submit the results for staff review. A summary of these analyses and their results are contained in Attachment 1.

A025

The analysis results in Attachment 1 evaluate the seismic response of portions of the RWSP purification system. The analysis reaffirms the conservatism in the RWSP purification system design and supports the engineering judgement of acceptable RWSP purification system seismic performance. Entergy is confident that a full RWSP purification system seismic analysis would demonstrate acceptable seismic performance. Based on the analyzed margins, conservatism of the analysis, and the robust design of the RWSP purification system, additional analyses would not improve safety. This position is based on several factors:

- The analysis performed is representative of the system in that it includes various span lengths and configurations.
- The Waterford 3 seismic floor response spectra are extremely low, as shown in Attachment 2, indicating there is a low potential for pipe damage during a seismic event.
- Based on detailed walkdowns, the piping is adequately supported in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section III and ANSI B31.1, "Code for Power Piping, B31.1," as applicable.
- The system was constructed, but not analyzed, to ANSI B31.1 requirements.
- The portion of the system and components that were not originally analyzed were evaluated by comparison with similar Seismic Category 1 piping and components and found to be acceptable.
- As documented in Attachment 1, the analysis results show considerable margin to the applicable acceptance criteria (>67% to Moderate Entergy Crack and >79% for Stress Ratios) providing confidence that the remaining unanalyzed portions of the system will also meet the acceptance criteria.
- Analyzed portions of the system yield results that do not require a crack be postulated. Entergy is confident that further analysis would yield comparable results. Entergy, however, is conservatively postulating that a crack occurs to provide additional assurance that the seismic response of the entire system is bounded.

Therefore, reasonable assurance of acceptable system performance during a seismic event has been established. If the staff believes additional seismic analysis is warrented, Entergy requests a meeting to address this item further.

In response to industry operating experience information, a revision to the calculation for the emergency core cooling system net positive suction head was required to account for the impact of system check valves. Accordingly, Entergy is revising the response to question 1 of the staff's August 31, 2001 request for additional information that was provided in reference 2. Attachment 3 contains this revised response. This revised response supercedes the response provided in reference 2.

The original no significant hazards considerations included in reference 1 is not affected by any information contained in this letter. There are no new commitments contained in this letter.

If you have any questions or require additional information, please contact D. Bryan Miller at 504-739-6692.

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 31, 2002.

Sincerely,

7/31/02

JEV/DBM/cbh

Attachments:
1. Summary of Seismic Analysis and Results
2. Waterford 3 Seismic Floor Response Spectra
3. Revised Response to Question 1 of the August 31, 2001 RAI

cc: E.W. Merschoff, NRC Region IV
N. Kalyanam, NRC-NRR
J. Smith
N.S. Reynolds
NRC Resident Inspectors Office
Louisiana DEQ/Surveillance Division
American Nuclear Insurers

Attachment 1

To

W3F1-2002-0071

Summary of Seismic Analysis and Results

Summary of Seismic Analysis and Results

Introduction

A large portion of the refueling water storage pool (RWSP) purification system was originally analyzed and qualified to be non-safety / seismically supported. (Reference Figures 1, 2, and 3.) This attachment summarizes the results of additional seismic analyses of two portions of the refueling water storage pool purification system, and provides additional technical support of the engineering judgement documented in the original submittal[1] establishing the adequacy of the system to withstand the effects of a seismic event. Walkdown verifications were also performed consistent with NRC and EPRI guidelines developed for the Individual Plant Examination of External Events (IPEEE) and Seismic Qualification Utility Group (SQUG) program requirements to confirm the accuracy of piping isometrics and spatial interactions. The portions of the system that were analyzed were assumed to bound expected system seismic performance. However, due to variations in the specific configuration for the portions reviewed, the results are conservatively considered to be representative of the overall system. The results of the analyses were reviewed to assure the reasonableness of applying assumptions to the overall system based on the margins available, walkdown results, engineering judgement, and previous analyses.

Entergy Operations, Inc. (Entergy) has analyzed a representative sample of the system to seismic standards, with the purpose of seismically qualifying the entire system by similarity. Piping attributes that were considered in selecting the representative sections included:

- Span lengths and length of straight segments that would maximize seismic response.
- Branch lines, which have higher stresses due to stress intensification.
- Number of in-line components such as valves and strainers, which would maximize dead weight and seismic loading.
- Number of supports, to provide a large sample size.

Tables 1 and 2 provide a comparison of these attributes for different major segments of piping.

Conclusion

Entergy has completed the analyses of the selected piping segments. The analysis results show pipe support loads within the allowable limits and very low stresses in the piping. The maximum stress in the pipe is approximately 21% of the allowable. The stresses are also well below the MEB 3-1 threshold criteria for postulation of moderate energy line cracks. As extra conservatism, however, a moderate energy line crack was postulated in the original submittal. Thus, both reasonable assurance of piping integrity and reasonable assurance for a conservatively postulated pipe crack demonstrate acceptable system performance.

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[1] Entergy letter dated April 2, 2001, "Request for Review and Approval of Design Basis Change Regarding Realignment of Refueling Water Storage Pool (RWSP) Boundary Isolation Valves to RWSP Purification System" (W3F1-2001-0007)

It is Entergy's position that the analysis performed is representative of the unanalyzed ANSI B31.1 portion of purification system and similar results would be obtained if the remainder of the system were analyzed. The analyses provide ample margin in support of this position, therefore it is not considered prudent to perform additional analysis. Walkdowns, piping isometric reviews, and engineering judgement support that the entire RWSP purification system is considered seismically supported based on similarity to the analyzed portions.

Analysis Methods and Results

In the Entergy analysis, dead weight, thermal and seismic loads were applied per ASME Class 3, and MEB 3-1 criteria. The seismic piping analysis was performed to the same criteria / standards as ASME Class 3 safety related pipe in regards to floor response spectra, etc. Additional criteria used in Entergy's analysis are:

1) As-building of piping isometrics was not required. Senior piping and structural engineers performed walk-downs that determined the isometrics were accurate in regards to layout, pipe support location, etc.

2) The analysis considered the representative conditions of piping spans, dead weight, and valve weights. Tables 1 and 2 show the comparison of the analyzed segments (Model A and B) and the remaining unanalyzed segments.

3) Wall penetrations were treated as piping restraints as appropriate. Grouted wall penetrations were considered anchors. Flexible fire seals with boots were modeled as springs using manufacturer test reports to determine the spring constant.

4) ASME Code Case N 411 was used for damping values in seismic analysis.

5) Pipe stress output was reviewed for uplift on rod hanger supports. No uplift occurred due to the higher dead weight and low seismic levels at Waterford 3.

6) Seismic qualification of valves in the system was not required since only overall structural integrity of the system is the concern, not functionality after a seismic event. The valve bodies have equal or better structural capacity than the pipe.

Two separate calculations were prepared and designated Model A and Model B. Model A is a large span of pipe with a single support in addition to the concrete penetrations. Model B is a long run of pipe with support spans varying from 6 to 12 feet.

Model A

Contained on isometrics E-2803-IC-271 and IC-292, Fuel Pool Filter cubicle room, Line 7FS3-10 from the outlet of the fuel pool filter to the roof penetration. Branch line 7FS3-9, inlet to the fuel pool filter from the roof of the cubicle room. Lines 7FS3-10 and 7FS3-9 are connected through valve FP229. It has both large horizontal and vertical spans of pipe with concentrated weight from valves. It has approximately 32 feet of pipe with one support in addition to the concrete penetrations. See Table 1 for additional information.

The following table provides the Model A analysis results and acceptance criteria. The results show that the minimum margin for stress ratios is 81% and the margin to moderate energy crack is 67%.

Parameter	Analysis Results	Acceptance Criteria
Stress Ratio Equation 8	0.186	<1.000
Stress Ratio Equation 9	0.171	<1.000
Stress Ratio Equation 9F	0.094	<1.000
Stress Ratio Equation10	0.105	<1.000
Moderate Entergy Crack 0.4(1.2Sh + SA)	5992 psi	<18216 psi
Hanger Uplift	None	None

Model B

Contained on isometrics E-2803- IC-271, IC-191, IC-187, IC-192, and IC-279. Inlet line to the ion exchanger is selected as the representative line. This covers portions of lines 7FS3-10, 12, 13, and 14. This produces an analysis of approximately 344 linear feet of pipe with 32 supports. See Table 1 for additional information. This section is considered representative of the unanalyzed portions of the system because:

- It contains piping spans ranging from approximately 6 feet to 12 feet.
- It contains a straight horizontal segment of approximately 75 feet which maximizes axial seismic loads.
- It has six in-line valves and one strainer that maximize dead weight and seismic effects.
- It contains four tees.

Tables 1 and 2 provide a comparison of these attributes for the different major segments of piping.

The following table provides the Model B analysis results and acceptance criteria. The results show that the minimum margin for stress ratios is 79% and the margin to moderate energy crack is 79%.

Parameter	Analysis Results	Acceptance Criteria
Stress Ratio Equation 8	0.168	<1.000
Stress Ratio Equation 9	0.208	<1.000
Stress Ratio Equation 9F	0.175	<1.000
Stress Ratio Equation10	0.000	<1.000
Moderate Entergy Crack 0.4(1.2Sh + SA)	3802 psi	<18216 psi
Hanger Uplift	None	None

Table 1
Analyzed Piping Sections (listed by isometric drawing)

SEGMENT	ISOMETRIC DRAWING	EMDRAC DRAWING	VALVES	BRANCH TEE	HORIZONTAL RUN	VERTICAL RUN	NO. of Supports	Analysis Results
Model A	E-2803-IC-271 E-2803-IC-292	4305-4426 4305-4437	2 valves	2 Tees	11.5' North-South 4.4' East West	17'	1 (plus penetration anchors)	Max Stress ratio =0.19
Model B	E 2803-IC-271 E 2803-IC-191 E 2803-IC-187 E 2803-IC-192 E 2803-IC-279	4305-4426 4305-4421 4305-4420 4305-4422 4305-4430	6 valves & 1 strainer	4 Tees	206.5' North-South 115' East West (75' straight segment)	22.6'	32 (plus penetration anchors)	Max. Stress ratio = 0.21

Table 2
Remaining Unanalyzed Piping Sections (listed by isometric drawing)

SEGMENT	ISOMETRIC DRAWING	EMDRAC DRAWING	VALVES	BRANCH TEE	HORIZONTAL RUN	VERTICAL RUN	NO. of Supports
1	E-2803-IC-281	4305-4431	1 valve	No Tees	78'-0" East-West (59' straight segment) 2'-9" North-South	28'-6"	10 (including existing Anchor)
2	E-2803-IC-690 E-2803-IC-689	4305-4442 4305-4441	No valves	No Tees	82' East-West (40' straight segment) 8'-3" North-South	12'-3"	10 (including existing Anchor)
3	E-2803-IC-279 E-2803-IC-834 E-2803-IC-689	4305-4430 4305-6847 4305-4441	1 valve (on IC-689)	One Tee (to IC-689)	23'-0" (approx.) East-West 57'(approx.) North-South (57' straight segment)	17'-0"	10 (including existing Anchor)
4	E-2803-IC-696 E-2803-IC-292 E-2803-IC-692	4305-4448 4305-4437 4305-4444	No valves	One Tee	7'-2" (approx.) East-West 70'-6"(approx.) North-South (46' straight segment)	2'-0"	8 (including existing Anchor)
5	E-2803-IC-836	4305-6849	No valves	No Tees	16'-0" East West 31'-8" North-South (31'-8" straight segment)	No Vertical Run	6 (including existing Anchor)

Simplified Isometric Drawings

Figure 1	SK-G-M-528
Figure 2	SK-G-M-529
Figure 3	SK-G-M-530

Note: The attached isometric drawings provide a visual representation of the system showing what portions have and have not been analyzed. These isometric drawings are not to scale.

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

SK-G-M-528, "RWSP REFUEL WATER STORAGE PURIFICATION SYSTEM"

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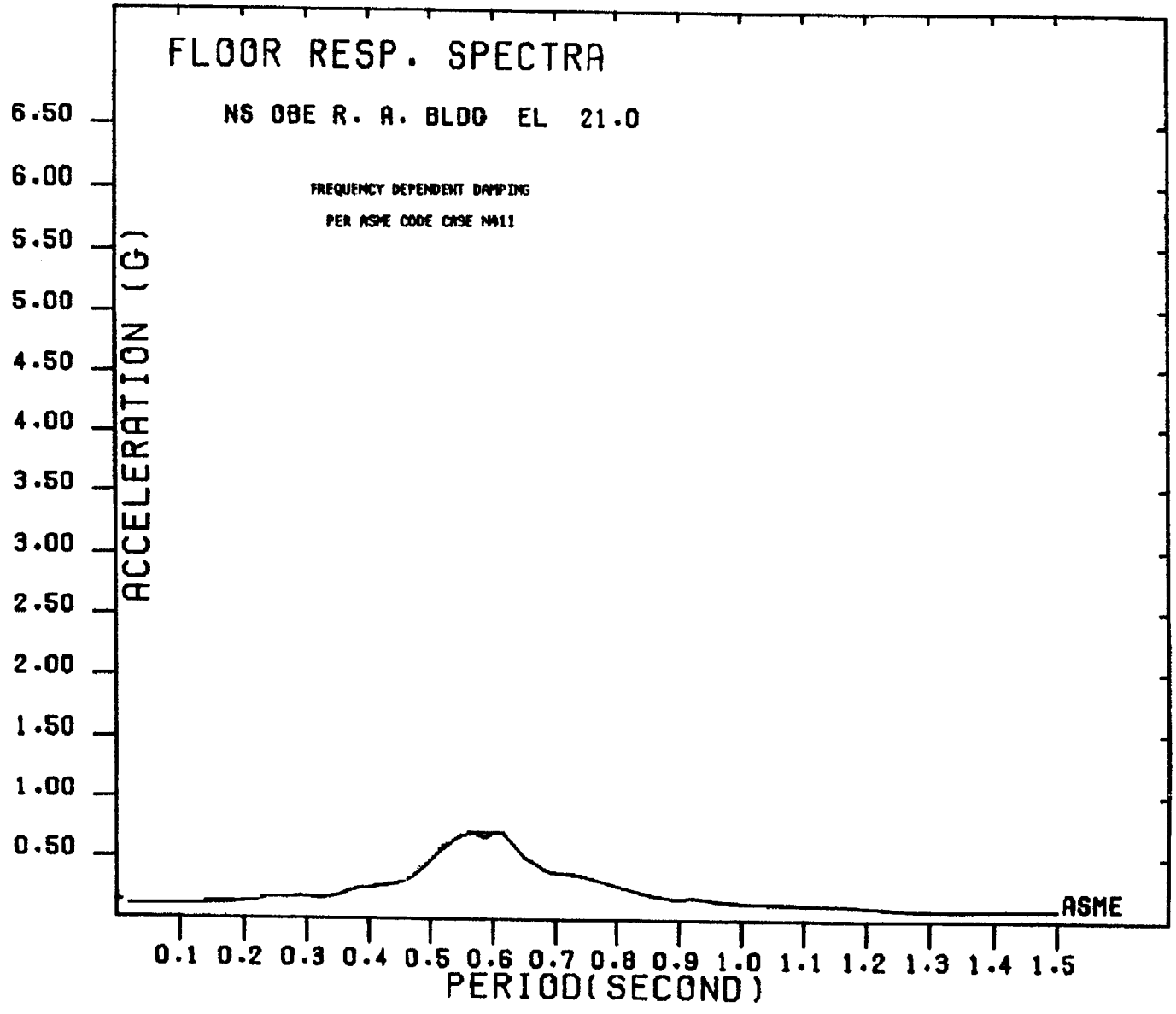
Attachment 2

To

W3F1-2002-0071

Waterford 3 Seismic Floor Response Spectra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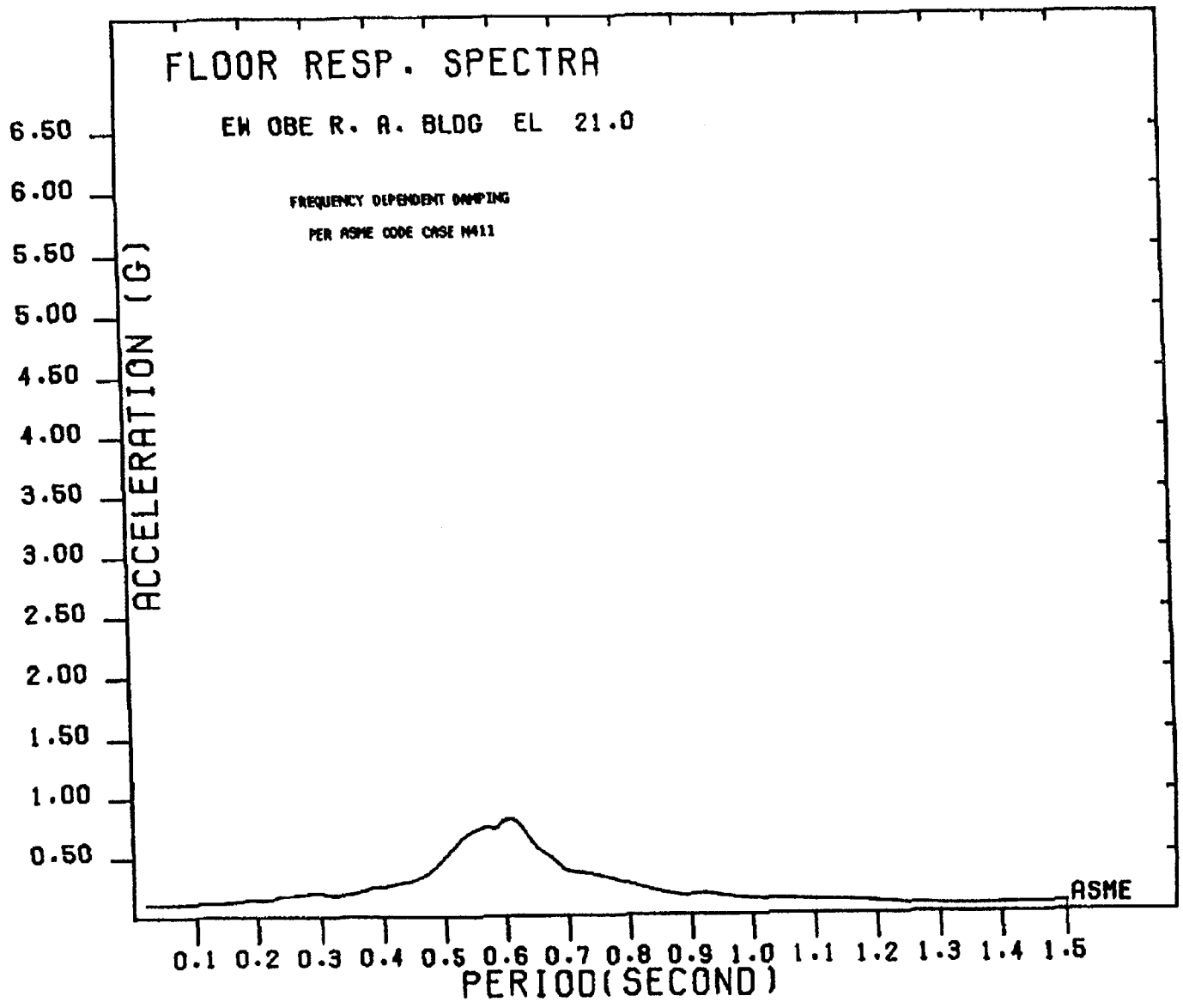
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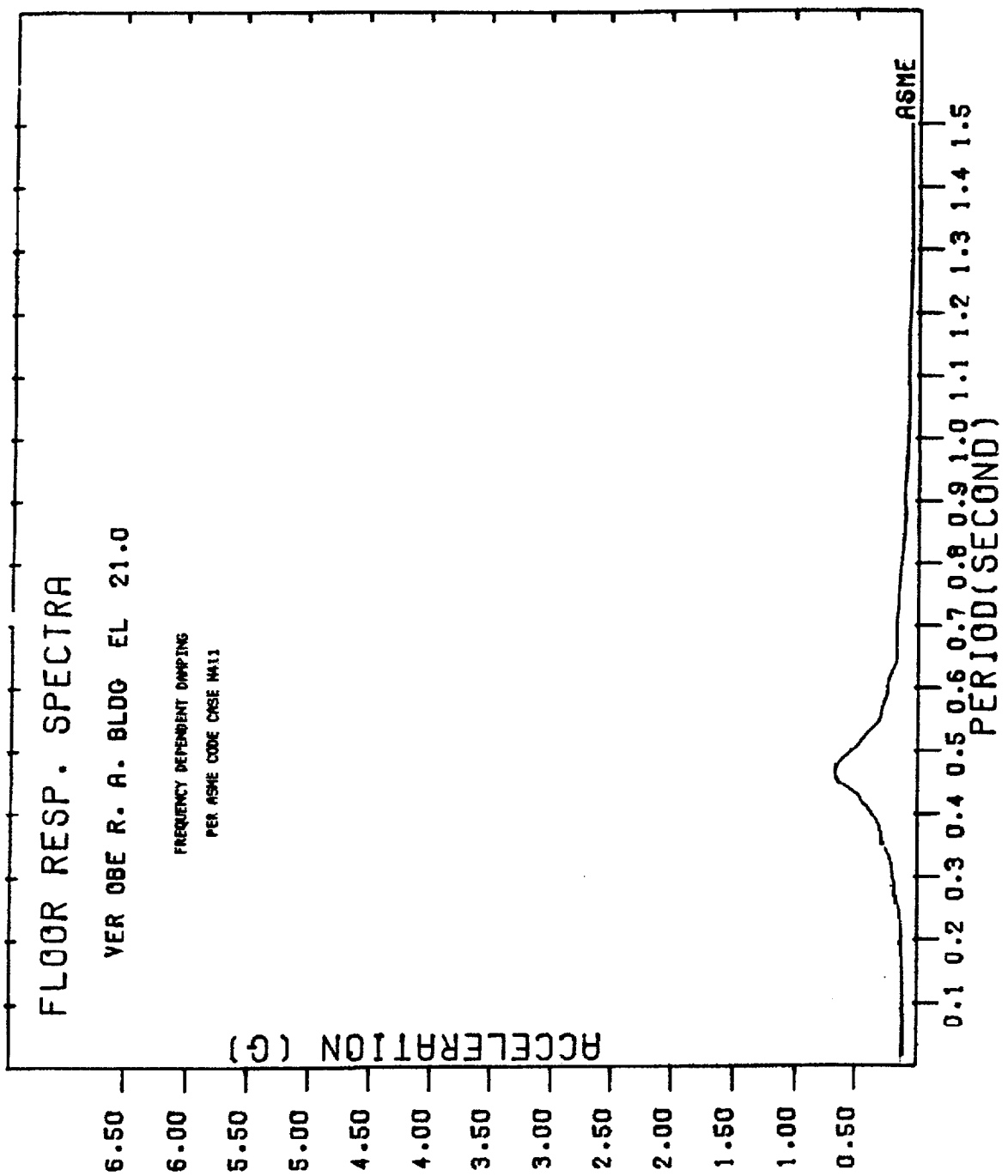
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Attachment 3

To

W3F1-2002-0071

Revised Response to Question 1 of the August 31, 2001 RAI

Revised Response to Question 1 of the August 31, 2001 RAI

The net positive suction head (NPSH) calculation for the high pressure safety injection and containment spray pumps was revised based on industry operating experience in accordance with the Entergy Operations, Inc. (Entergy) corrective action program to incorporate head loss information for check valves SI-604A(B) and SI-201A(B). The revision decreased the available NPSH for these pumps thus necessitating a revision to the response to the August 31, 2001 Plant Systems Branch request for additional information, Question 1. This revised response supercedes the response provided in Entergy's September 24, 2001 letter.

Question 1:

Please explain how the margin of 1.29 ft. in the following statement on page 7 of the submittal is derived:

> *"A margin exists between the actual volume available to ensure NPSH* [Net Positive Suction Head] *and the manufacturer's required NPSH. This NPSH margin of approximately 1.29 ft. SIS* [Safety Injection Sump] *level more than accounts for the combined instrument uncertainty for the RWSP water level...."*

Also, please explain the rationale for the assumption in this paragraph stating that instrument uncertainty is implicitly accounted for in the RWSP analytical level 76.4% due to NPSH conservatism.

Response 1:

The emergency core cooling systems (ECCS) (i.e., containment spray and high pressure safety injection) pump NPSH calculation documents the NPSH margin when the pumps are taking suction from the safety injection sump (SIS). The available NPSH for the pumps is calculated using a saturated sump model. The containment is conservatively assumed to be at the saturation pressure corresponding to the containment sump temperature. The calculation methodology used to determine the NPSH margin available is described in Final Safety Analysis Report (FSAR) Section 6.2.2.3.2.1. The recently revised calculation concludes that the ECCS pumps have adequate NPSH margin, at least 0.88 ft, for all expected pumped fluid temperatures without reliance on containment over pressure. This complies with the NPSH design requirements for ECCS pumps given in Regulatory Guide 1.1 (11/2/70).

Due to the reduction in NPSH margin from 1.29 feet to 0.88 feet the instrument uncertainty is no longer addressed implicitly as discussed in the original submittal. The RWSP water volume assumed has been explicitly determined to account for instrument uncertainties. Therefore, the calculated uncertainty is enveloped by the NPSH margin.