STONE & WEBSTER ENGINEERING CORPORATION

CLIENT & PROJECT **PRIVATE FUEL STORAGE FACILITY – PRIVATE FUEL STORAGE, LLC**				PAGE 1 OF 15 PLUS 2 OF ATTACHMENTS	
CALCULATION TITLE **Additional Information for NRC Review**				QA CATEGORY (X) X I - NUCLEAR SAFETY RELATED __ II __ III __ OTHER	
CALCULATION IDENTIFICATION NUMBER					
J.O. OR W.O. NO.	DIVISION & GROUP	CURRENT CALC. NO.	OPTIONAL TASK CODE	OPTIONAL WORK PACKAGE NO.	
05996.02	**STRUCTURAL**	**SC-15**	**NA**	**345BC**	

APPROVALS - SIGNATURE & DATE			REV. NO. OR NEW CALC. NO	SUPERSEDES CALC. NO. OR REV. NO.	CONFIRMATION REQUIRED (X)	
PREPARER(S)/DATE(S)	REVIEWER(S)/DATE(S)	INDEPENDENT REVIEWER(S)/DATE(S)			YES	NO
Bruce E. Ebbeson B.E.Ebbeson 05/11/01	Alex Cokonis A. Cokonis 05/14/01	Alex Cokonis A. Cokonis 05/14/01	0	N/A		X

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PREPARER/DATE	REVIEWER/CHECKER/DATE	INDEPENDENT REVIEWER
B.E. Ebbeson 05/11/01	A. Cokonis 05/14/01	A. Cokonis 05/14/01

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TABLE OF CONTENTS AND HISTORICAL DATA

(Revisions, Additions, Deletions, Etc.)

HISTORICAL DATA - REVISION 0

Page No.	Description
None	Original Issue

OBJECTIVE:

The purpose of this calculation is to develop information needed to respond to requests for information made by the Nuclear Regulatory Commission (NRC). Specifically, the item addressed in Revision 0 of this calculation is item 3 under the topic "Seismic Hazard Analysis" in the letter of Reference 1. See Attachment A.

CALCULATION METHOD :

The comparison of free field motion and CTB foundation motion will be made by plotting together the design ground response spectra, obtained from Reference 2, the response spectra of the free field artificial time histories, developed in Reference 2 (shortened to 20 second duration as described in Reference 3), and the response spectra at the bottom of the mat, developed in this calculation. The response spectra of the artificial time histories were generated using the qualified Stone & Webster computer program TIMHIS6 (Reference 4). To get the response spectra at the CTB base mat, the acceleration time histories at the mat were developed using the qualified Stone and Webster computer program FRIDAY (Reference 5), using the same models as those developed in Reference 3. These time histories were then used as input to TIMHIS6 to develop the response spectra. This was done for each of the directions of motion (north-south, vertical and east-west), and for each of the three soil cases (upper bound, best estimate and lower bound). Results were plotted using EXCEL.

ASSUMPTIONS:

The NRC requested that results at the top of the mat be compared to the free field motion. The results presented herein are at the bottom of the mat. It is assumed that there is negligible difference between results at the top and bottom of the mat.

SOURCES OF DATA AND EQUATIONS:

See page 5.

CONCLUSION:

The comparison of response spectra at the mat are compared to the free field response spectra are shown on pages 7-15.

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B.E.Ebbeson 05/11/01	A. Cokonis 05/14/01	A. Cokonis 05/14/01

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References:

1. Letter dated April 25, 2001, from Mark S. Delligatti (NRC) to Susan M. Frant (NRC). See Attachment A for relevant pages.
2. Geomatrix Calculation 05996.02-G(P018)-3, Rev. 1, 'Development of Time Histories for 2000 Year Return Period Design Spectra'
3. Calculation 05996.02-SC-5, Revision 2, "Seismic Analysis of Canister Transfer Building".
4. SWEC Computer Program TIMHIS6, ST-239, Version 01, Level 01.
5. SWEC Computer Program FRIDAY, ST-243, Version 02, Level 01.

DESIGN GROUND SPECTRA

The design ground spectra are provided in Reference 2, and the digitized information was entered manually into EXCEL. The fault parallel spectrum is designated as the X direction, the vertical spectrum is designated as the Y direction, and the fault normal spectrum is designated as the Z direction. These correspond to the north-south, vertical and east-west directions, respectively.

ARTIFICIAL TIME HISTORIES

The response spectra (5% damping) of the artificial time histories were obtained by taking the shortened time histories developed in Reference 3 and using them as input to the Stone and Webster program TIMHIS6 (Reference 4). The input to and output from this analysis is contained on the diskette of Attachment B. The filename is "timhisgr". Resulting response spectra were extracted and imported to EXCEL for plotting.

RESPONSE SPECTRA AT MAT

To get the response spectra at the mat, first the acceleration time histories were developed. This was done by using the CTB model developed in Reference 3, and applying the artificial time histories as input motion, using the Stone and Webster program FRIDAY. Acceleration time histories were obtained at the bottom of the mat (joint 1 of the model), and stored. The input to and output from FRIDAY are contained on the diskette of Attachment B, with the following filenames:

"fridaybe"	best estimate soil case
"fridayub"	upper bound soil case
"fridaylb"	lower bound soil case

The acceleration time histories output from FRIDAY were used as input to TIMHIS6 to develop the response spectra (5% damping) at the bottom of the mat. The input to and output from TIMHIS6 are stored on the diskette of Attachment B. The filenames are:

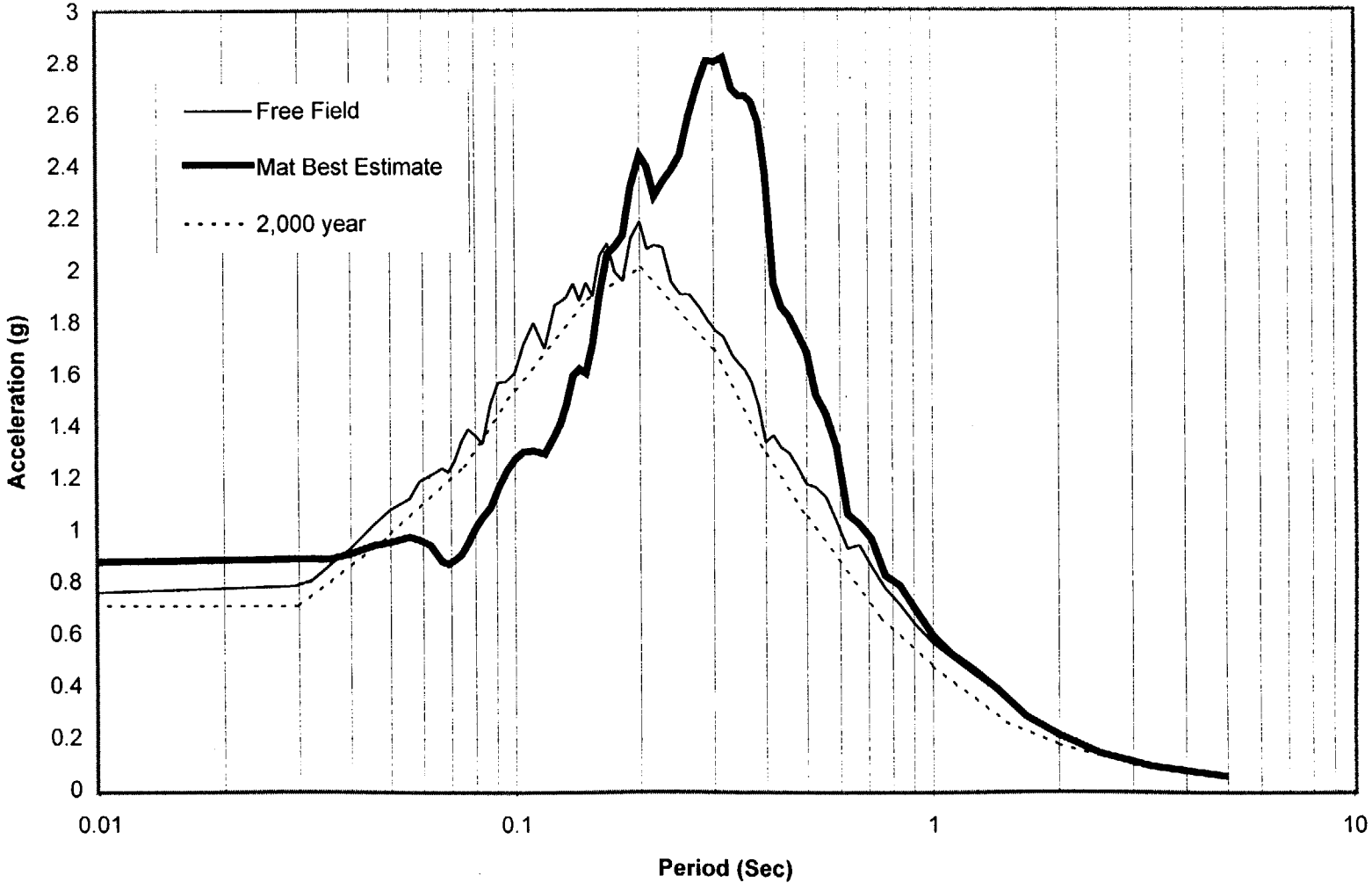
"timhisbe"	best estimate soil case
"timhisub"	upper bound soil case
"timhislb"	lower bound soil case

The resulting response spectra were extracted and imported into EXCEL for plotting.

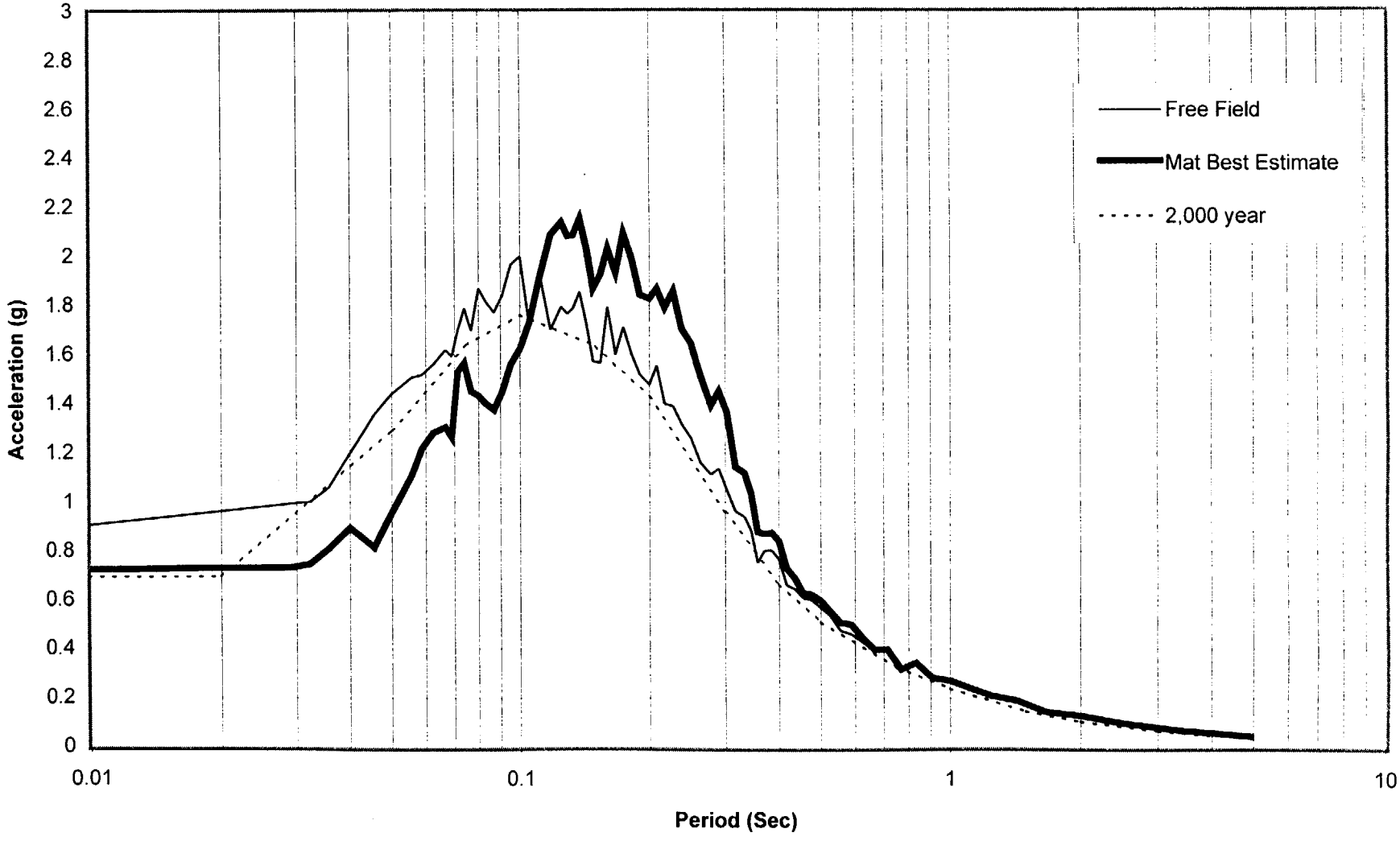
PLOTS

Comparison plots are presented on the following pages.

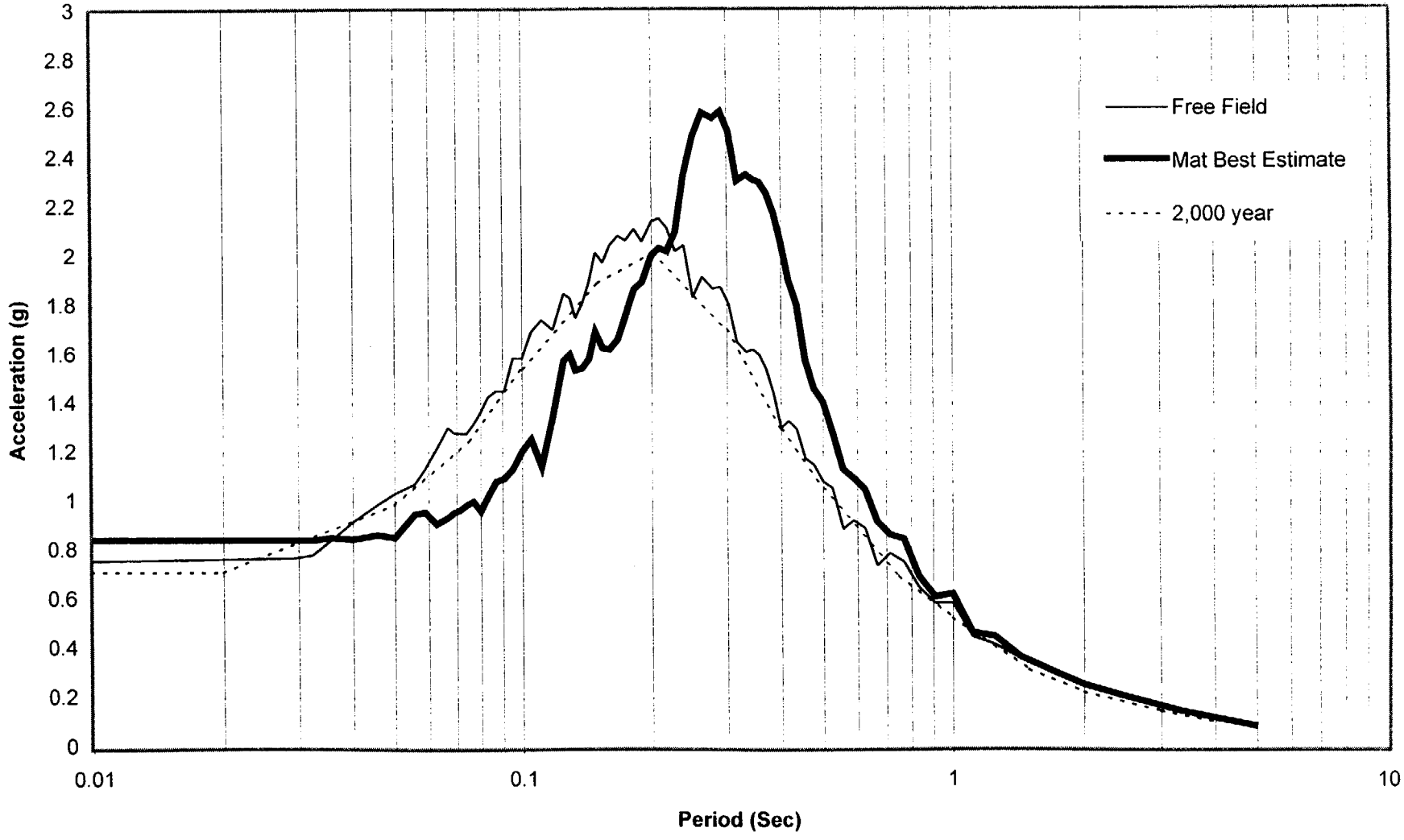
Comparison of Response Spectra, N-S Direction, 5% Damping
Best Estimate Soil Case



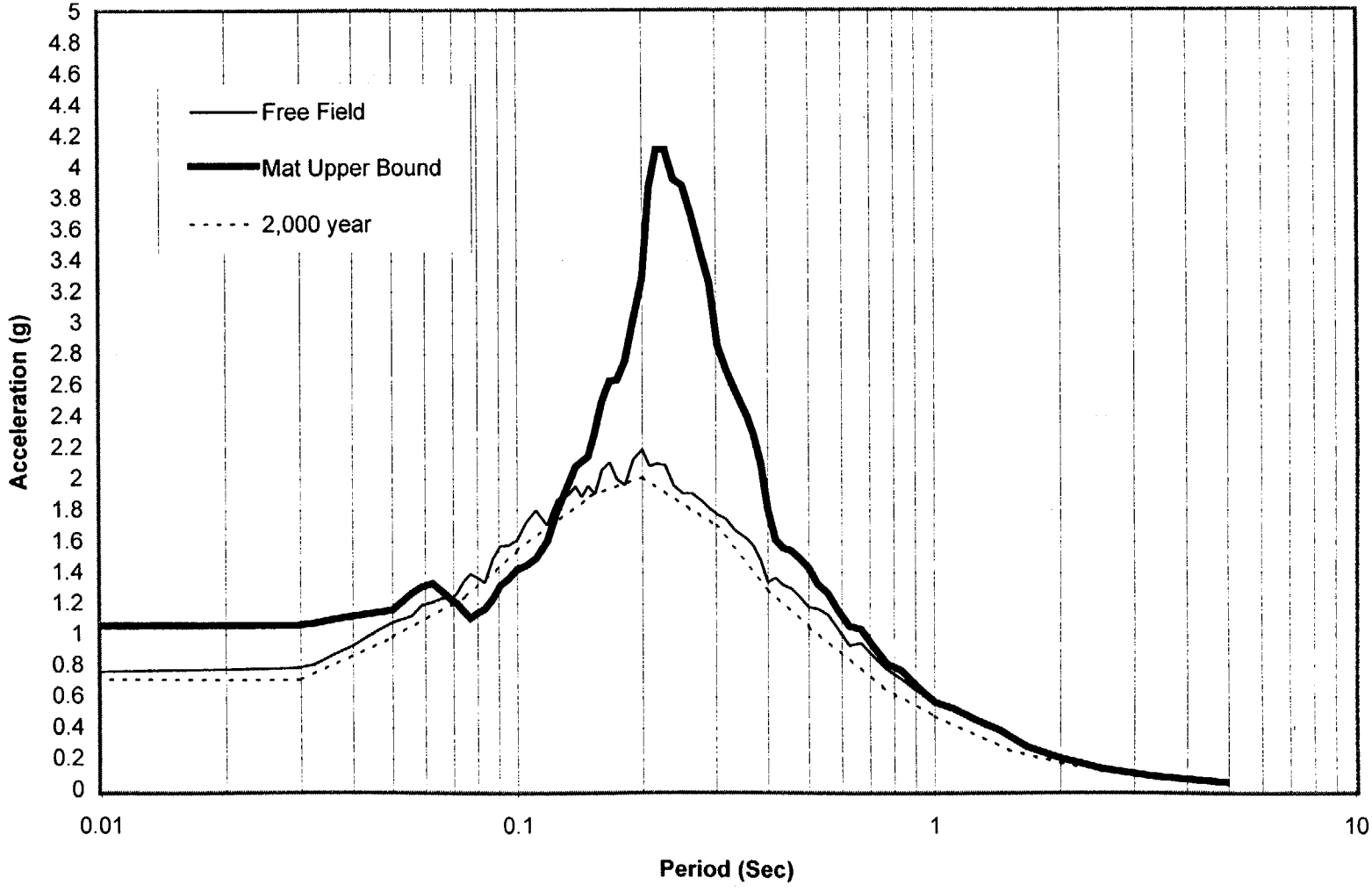
Comparison of Response Spectra, Vertical Direction, 5% Damping
Best Estimate Soil Case



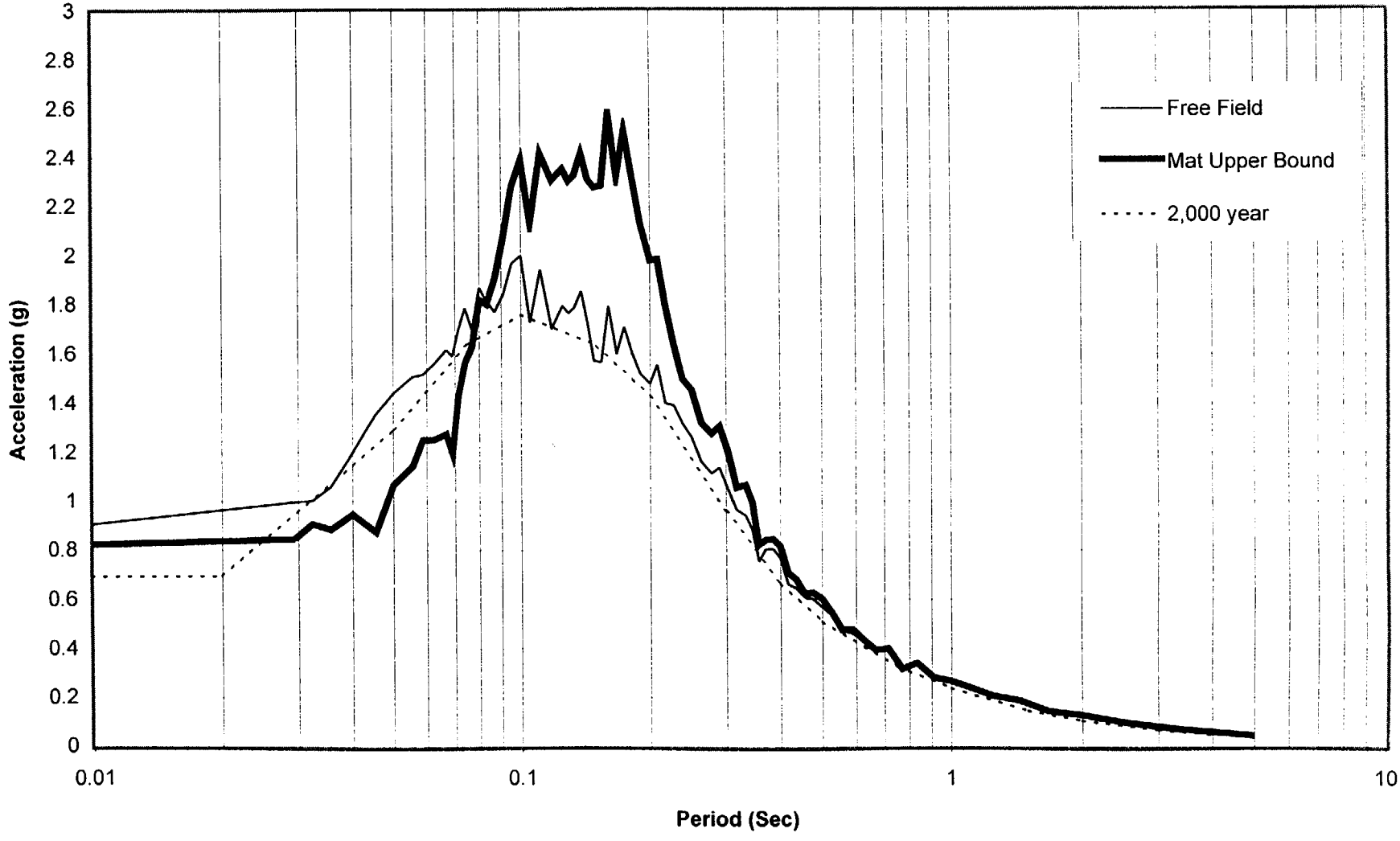
Comparison of Response Spectra, E-W Direction, 5% Damping
Best Estimate Soil Case



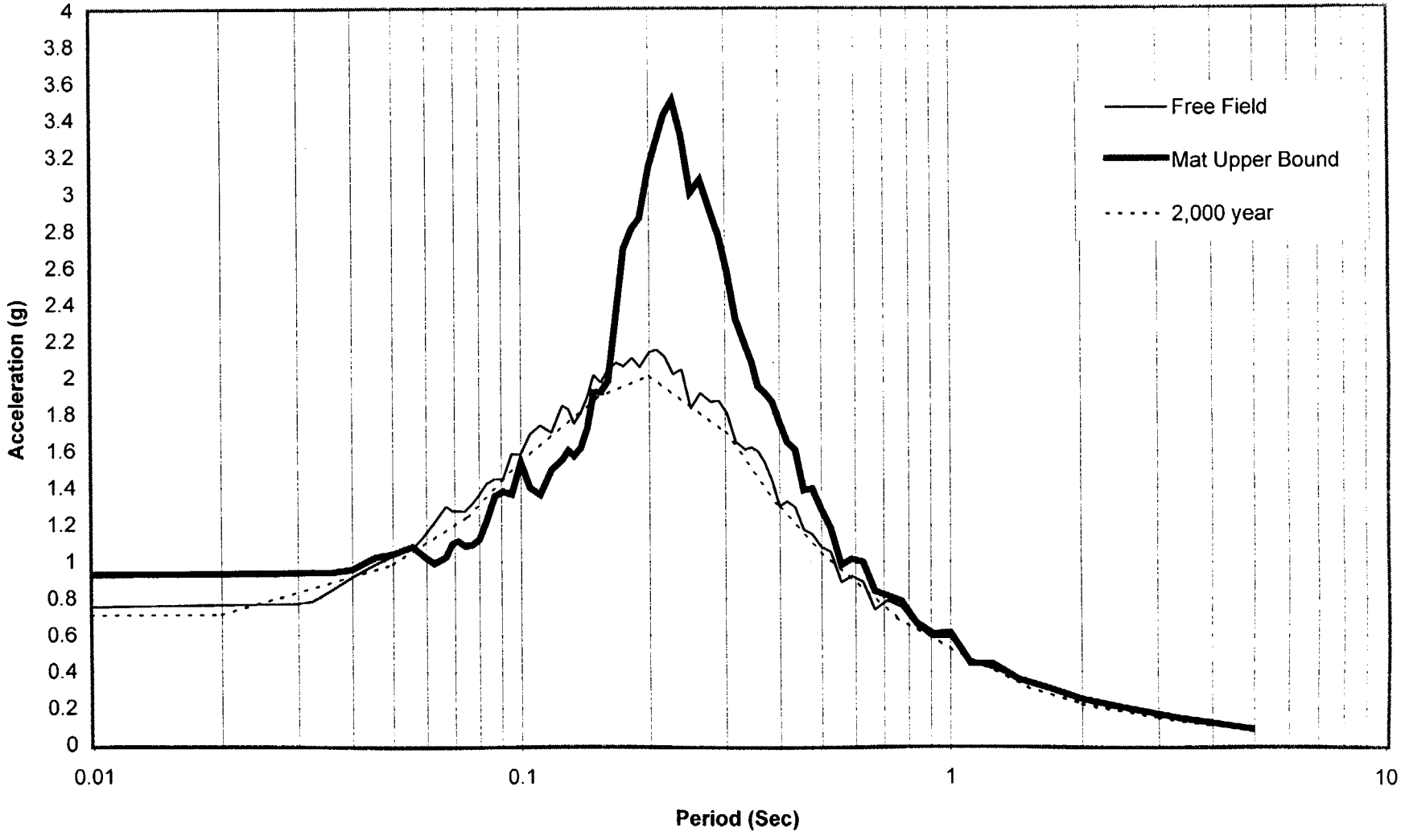
Comparison of Response Spectra, N-S Direction, 5% Damping
Upper Bound Soil Case



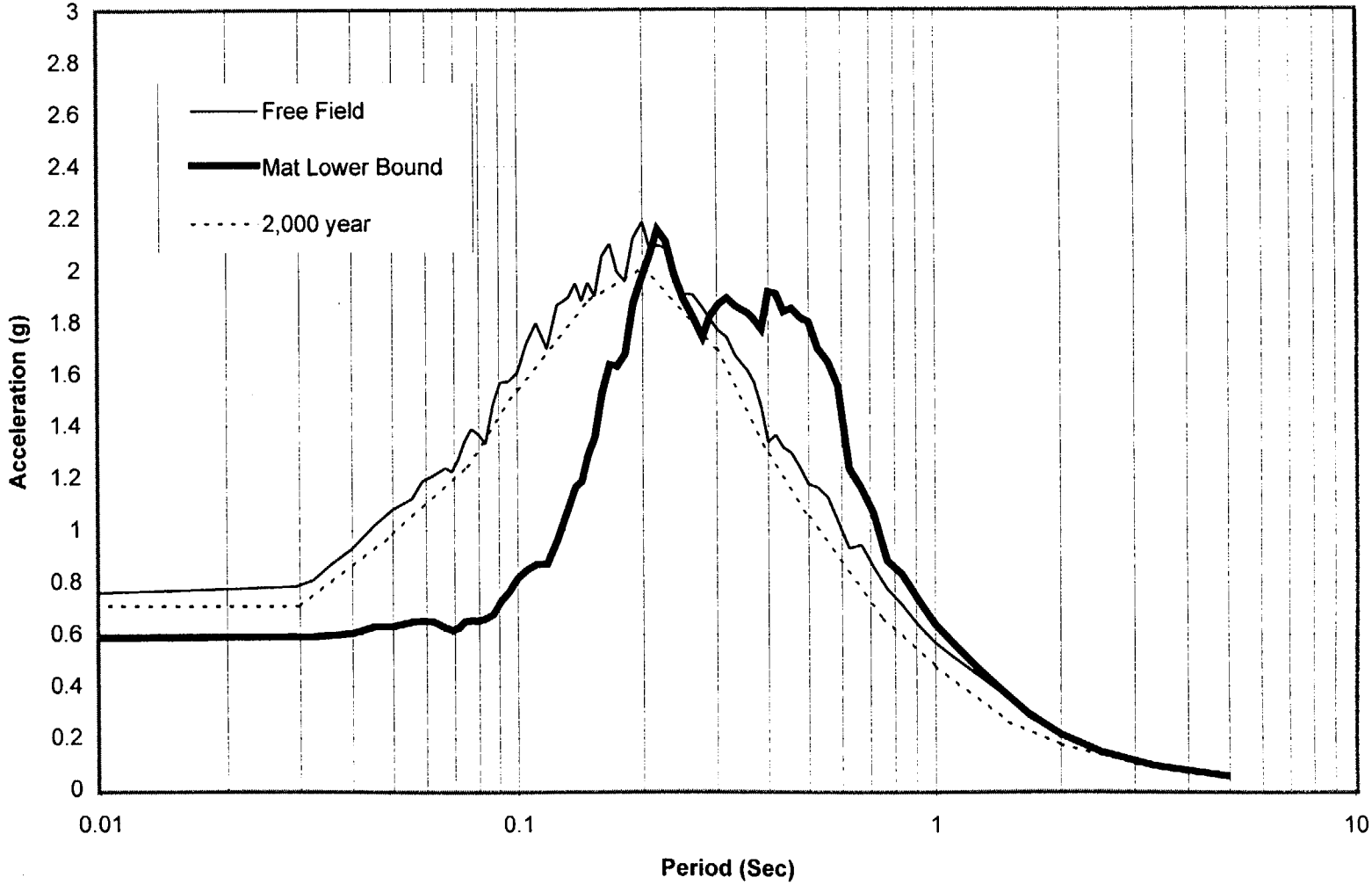
Comparison of Response Spectra, Vertical Direction, 5% Damping
Upper Bound Soil Case



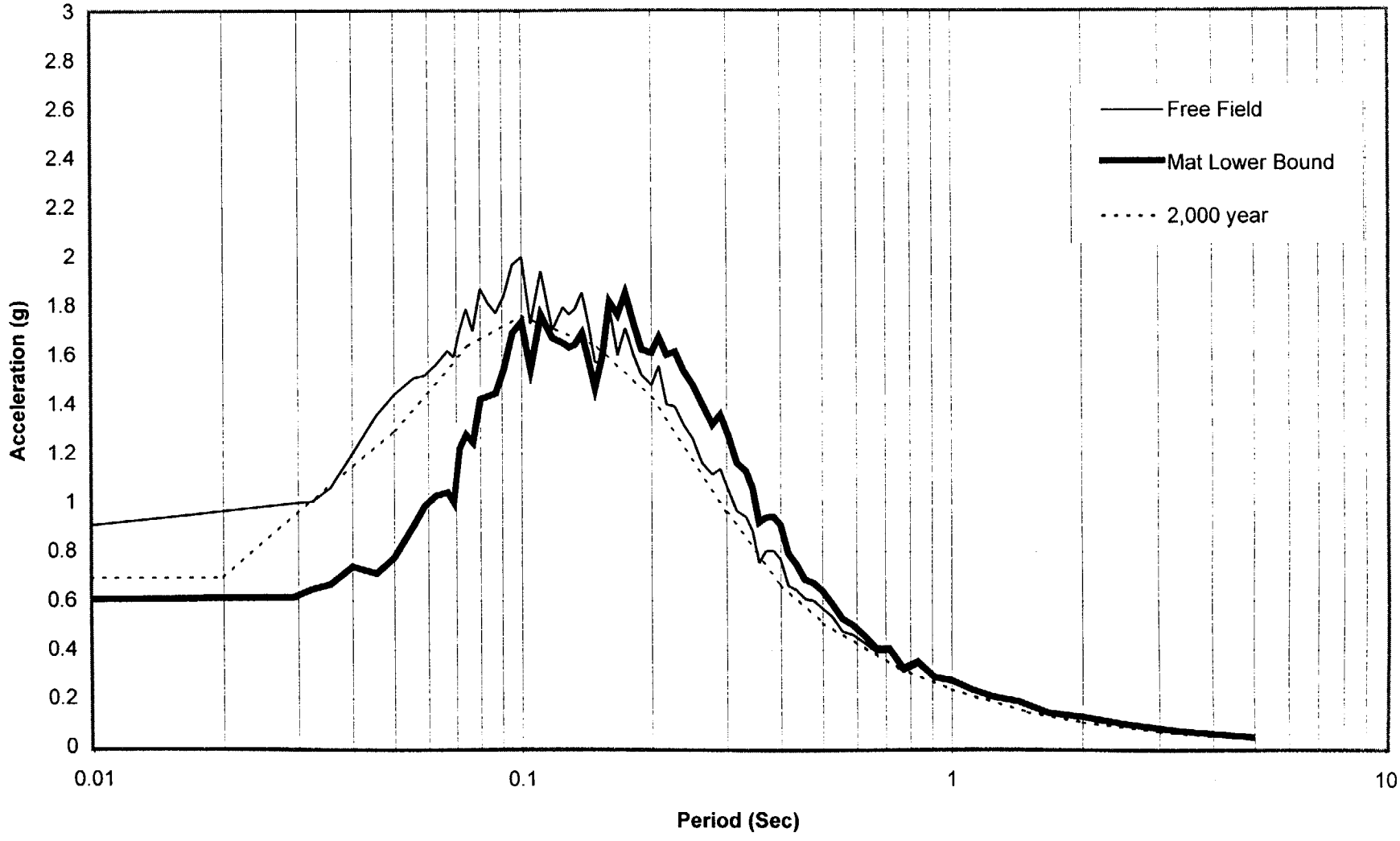
Comparison of Response Spectra, E-W Direction, 5% Damping
Upper Bound Soil Case



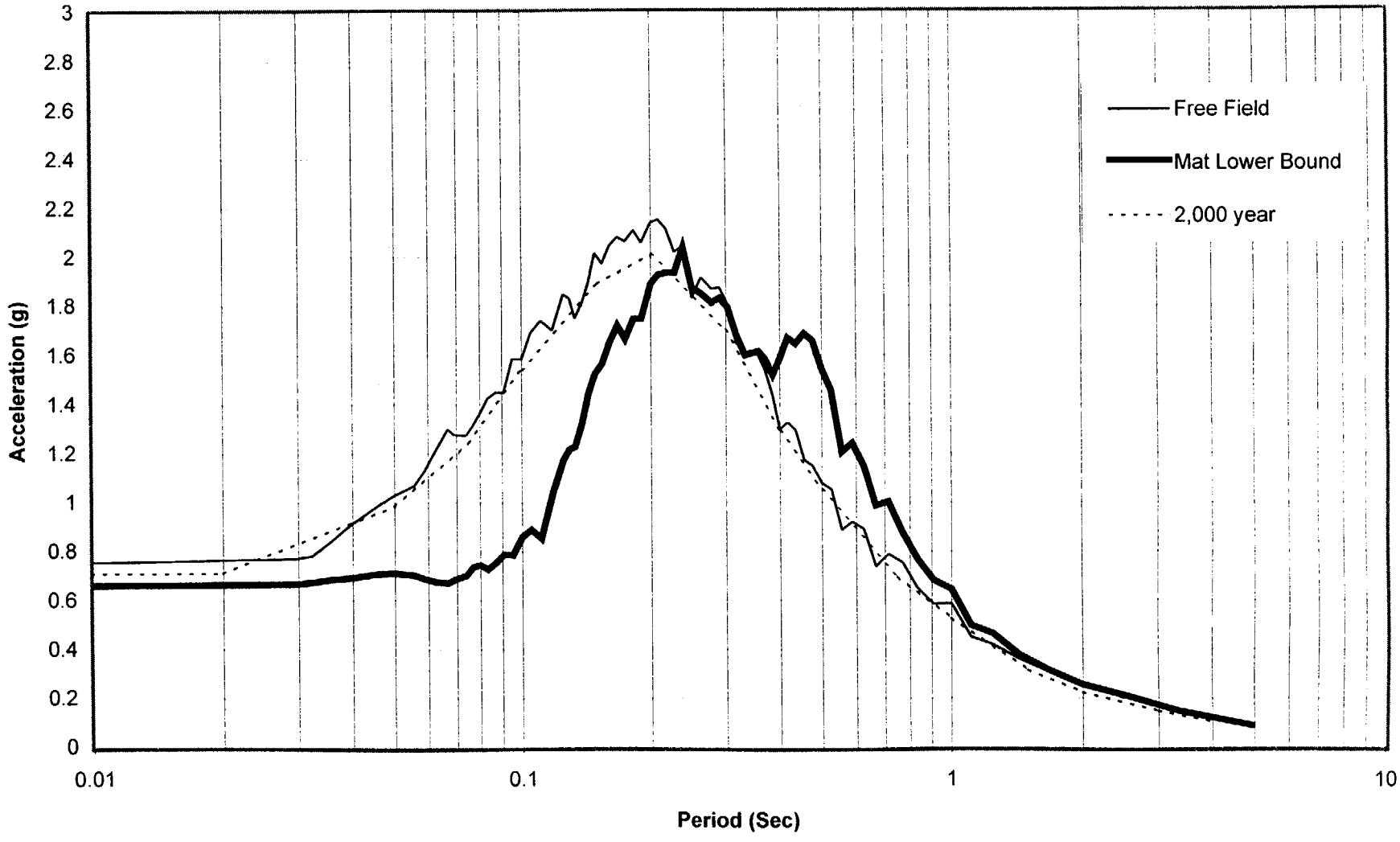
Comparison of Response Spectra, N-S Direction, 5% Damping
Lower Bound soil Case



Comparison of Response Spectra, Vertical Direction, 5% Damping
Lower Bound Soil Case



Comparison of Response Spectra, E-W Direction, 5% Damping
Lower Bound Soil Case



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Attachment A

DATA NEEDED FOR THE COMPLETION OF THE PFS LA AMENDMENT

DATA NEEDED FOR THE COMPLETION OF THE PFS LA AMENDMENT

Seismic Hazard Analysis:

The following data is needed to complete a review of the new seismic hazard attenuation results submitted in the PFS LA Amendment:

1. Deaggregated hazard curves (mean and fractiles) for horizontal and vertical ground motion for each attenuation and site response model at all 16 frequencies.

2. Site velocity measurements, the 30 random property models (all parameters - shear wave velocity, damping, modulus reduction ratio as a function of shear strain, results of simulations, and input spectra (earthquake magnitude and distance matrix of inputs).

3. Results of the soil structure interaction calculations - spectral ratio of free field vs. building structural foundation (top) motion.

4. Confirmation from the Bay Geophysical experts that the new shear wave velocities will not alter conclusions of the shallow seismic reflection profiles.

5. Complete description of the site soil characterization update including:

   a. site data,
   b. discussion of the site investigation timeline,
   c. complete description of the evolution of the site model, noting parameters that have remained constant as well as those that have changes,
   d. suite of sensitivity results that show the ramifications of changing from a "soil" model to a "rock" model,
   e. sensitivity results to demonstrate the sensitivity (or insensitivity) of the weighting factor (empirical vs model).

6. Complete revised hazard analysis report (or at least a complete section 6).

7. Well data for soil below 30 ft.

8. More site specific data (i.e., beyond the one existing deep well) for the soil between 30 ft and the Tertiary strata or provide an analysis that shows that the applicant has captured the uncertainty of the soil properties sufficiently such that any new information will not again significantly change the ground motions (i.e., sensitivity study of the site response model that would incorporate the variability of the soil parameters expected for this site).

Soil Engineering:

1. A site plan showing location of any new borings and test pits used to support PFS analyses.

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B.E. EBBESON 5-11-01	A. Cokonis 5/14/01	A. Cokonis 5/14/01

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ATTACHMENT B

DISKETTE