REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 8710140073 DOC. DATE: 87/10/06 NOTARIZED: NO DOCKET #
FACIL: 50-315 Donald C. Cook Nuclear Power Plant, Unit 1, Indiana & 05000315
50-316 Donald C. Cook Nuclear Power Plant, Unit 2, Indiana & 05000316
AUTH. NAME AUTHOR AFFILIATION
ALEXICH, M. P. Indiana Michigan Power Co.
RECIP. NAME RECIPIENT AFFILIATION
MURLEY, T. E. Document Control Branch (Document Control Desk)

SUBJECT: Forwards, per 870410 util ltr, final seismic analysis rept, "Crane Seismic Rept, Cask Handling Crane, 150 Ton Capacity, Existing Bridge S/N 10038, New Trolley S/N 12124," & info re plant design response spectra & FSAR damping values.

SEE REPTS.
DISTRIBUTION CODE: A001D COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 16+245
TITLE: OR Submittal: General Distribution

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	PD3-3 LA	1	0	PD3-3 PD	5	5
	WIGGINGTON, D	1	1			
INTERNAL:	ARM/DAF/LFMB	1	0	NRR/DEST/ADS	1	1
	NRR/DEST/CEB	1	1	NRR/DEST/MTB	1	1
	NRR/DEST/RSB	1	1	NRR/DOEA/TSB	1	1
	NRR/PMAS/ILRB	1	1	OGC/HDS1	1	0
	REG FILE 01	1	1	RES/DE/EIB	1	1
EXTERNAL:	EG&G BRUSKE, S	1	1	LPDR	1	1
	NRC PDR	1	1	NSIC	1	1

TOTAL NUMBER OF COPIES REQUIRED: LTTR 21 ENCL 18

Indiana Michigan
Power Company
P.O. Box 16631
Columbus, OH 43216

INDIANA
MICHIGAN
POWER

AEP:NRC:0514W

Donald C. Cook Nuclear Plant Units 1 and 2
Docket No. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
AUXILIARY BUILDING CRANE MODIFICATION
FINAL SEISMIC ANALYSIS REPORT

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

Attn: T. E. Murley

October 6, 1987

Dear Dr. Murley:

Ref: Our Letter AEP:NRC:0514T, dated April 10, 1987.

As noted in the above-referenced letter, this submittal transmits the final seismic analysis report entitled "Crane Seismic Report, Cask Handling Crane, 150 Ton Capacity, Existing Bridge S/N10038; New Trolley S/N12124," dated August 21, 1987, performed by Whiting Corporation. This analysis is for the modified auxiliary building crane with a new trolley built to meet the single-failure-proof requirements of NUREG-0554. The design-rated load (DRL) of the modified crane is 150 tons, and the maximum critical load (MCL) of the modified crane is 55 tons during and after a plant design-basis earthquake (DBE). Attachment 1 contains the information on plant design response spectra and the damping values as stated in our FSAR. The building response spectra at the elevation where the crane is located are presented in Appendix A of the Whiting seismic report. Attachment 2 is the final seismic analysis report prepared by Whiting Corporation.

We believe that with the modifications noted above, the crane meets the single-failure-proof requirements of NUREG-0554 and that operational restrictions on the crane to meet the requirements of NUREG-0612 and T/S Section 3.9.7 will no longer be required. We are in the process of preparing a T/S change request to Section 3.9.7 and will be submitting it to the NRC shortly.

A001
1/1

A check in the amount of $150.00 was transmitted with the above-referenced submittal.

This document has been prepared following Corporate procedures which incorporate a reasonable set of controls to insure its accuracy and completeness prior to signature by the undersigned.

Sincerely,

M. P. Alexich
Vice President

cm

cc: John E. Dolan
W. G. Smith, Jr. - Bridgman- w/attachments
R. C. Callen
G. Bruchmann
G. Charnoff
NRC Resident Inspector - Bridgman- w/attachments
A. B. Davis - Region III- w/attachments

ATTACHMENT NO. 1

TO

AEP:NRC:0514W

2.5 ENGINEERING SEISMOLOGY

The site lies in a region which has experienced very little earthquake activity. No major earthquakes have had epicenters closer than about 400 miles to the plant site. There has been some minor earthquake activity closer to the site; however, no shocks within 50 miles of the site have been large enough to cause significant structural damage. A complete report of site seismology is included in Appendix A to the Preliminary Safety Analysis Report.

2.5.1 SEISMICITY

The epicentral locations of all reported earthquakes with Modified Mercalli Intensities of V or greater in the region surrounding the site are shown on Figure 2.5-1, Epicentral Location Map. The closest Intensity IV shock is also shown. Only three recorded earthquakes with epicentral intensities of V or greater have occurred within approximately 100 miles of the plant site. These were of relatively low intensity, barely strong enough to cause even slight structural damage. The two largest earthquakes in the vicinity of the site had maximum intensities of VI. The first occurred near Fort Dearborn (Chicago) Illinois, about 70 miles from the site, in 1804. The second occurred in south-central Michigan about 75 miles from the site, in 1947. An Intensity V earthquake occurred near Milwaukee, Wisconsin in 1947. A weak earthquake with a maximum intensity of IV occurred in 1938 on the south shore of Lake Michigan about 30 miles from the site. This earthquake did no damage but was felt over a relatively large area.

A possible earthquake occurred in 1883 near Kalamazoo, Michigan about 50 miles northeast of the site. The maximum intensity for this event is listed as VI since there is a record of some minor damage in Kalamazoo. However, information is available which indicates that the damage may have been caused by an explosion and not an earthquake.

It is likely that most of the minor earthquake activity in the Michigan Basin is related to readjustments along zones of weakness in the bedrock, probably caused by glacial rebound. This same mechanism probably caused the minor earthquakes reported in northern Ohio, Lake Erie and western New York State. The 1947 earthquake in south-central Michigan may be related to a possible northwest trending fault located 50 miles northeast of Benton Harbor. Other seismic activity is related to fault systems bordering the Michigan Basin such as the Findlay Arch System in western Ohio. Some of the larger shocks from this area have been felt in southern Michigan.

In summary, it may be stated that the seismicity of the region is low. Although no major earthquake has originated closer than about 400 miles to the plant site, several damaging shocks have occurred close enough to be of significance. A list of the closest significant earthquakes in the region is presented in Table 2.5-1, Earthquakes with Epicenters located within 200 miles of Plant Site.

While several of these shocks were possibly felt in the vicinity of the site, no damaging effect would have been experienced from them. In the event of a recurrence of an historical earthquake, no damage would be experienced at the site by reasonably well-designed structures.

2.5.2 A SEISMIC DESIGN

Foundation Materials

The site is underlain by a simple sequence of formations consisting of a surface stratum of dune sand underlain by dense beach sands, a stiff clay stratum and, glacial till resting on shale-bedrock. Major plant structures are supported on mat foundations installed on the overlying compact sand, recompacted sand, or stiff clay deposits.

Available data from past earthquakes indicate that compact glacial till and competent bedrock perform well under dynamic loading. Dynamic laboratory testing on samples of the compact beach sand and the upper lake bed deposits of silty clay indicates that these materials would experience no significant loss in strength during any potential earthquake.

Operating Basis Earthquake

On the basis of the seismic history of the area, it appears extremely likely that the site will not experience any significant earthquake motion during the life of the plant. Based on the history of previous earthquake activity in the area, it is estimated that the maximum ground motion to which the site may be subject during its life would be due to a shock similar to the 1947 south-central Michigan earthquake. It is estimated that the magnitude of this shock was no greater than about 4½ on the Richter Scale. This earthquake possibly may be related to a postulated fault structure trending northwest-southeast through southwest Michigan. The closest approach of this postulated structure to the site is about 50 miles to the northeast. It is estimated that the ground acceleration at the site due to a magnitude 4½ earthquake at a distance of 50 miles would be barely perceptible at the site. The largest earthquake in the region occurred near Lima, Ohio, in 1937. It has an epicentral Intensity of VII to VIII and was felt over an area of about 150,000 square miles. The magnitude of this earthquake has been estimated at about 5½. This earthquake was related to local faulting associated with the Findlay Arch. The closest approach of the Findlay Arch or any related structure to the site is about 130 miles. An earthquake of magnitude 5½ at an epicentral distance of 130 miles would be barely perceptible at the site. On a historical basis, it does not appear necessary to incorporate a seismic factor in the elastic design of the power plant. However, in view of the nature of the facility, the major structures are conservatively designed for a maximum

horizontal ground acceleration of 10 percent of gravity and a maximum vertical acceleration of 6.66 percent of gravity. The seismic design requirements of the reactor containment structure are given in Chapter 5 and the requirements for other structures and equipment are given in Sub-Chapter 2.9. The dynamic analysis of the containment structure for seismic loading is in Appendix F to the Original Safety Analysis Report.

Design Basis Earthquake

The maximum potential earthquake for this site is considered to be a recurrence of the largest recorded earthquake in a nearby region at the closest epicentral distance consistent with geologic structure. A number of earthquakes in the region have not been related to known tectonics. These shocks may have their origin in the crystalline basement rock where the structure is complex. They may occur along zones of weakness, triggered by glacial rebound. Historically, such shocks have been minor, with estimated magnitudes not exceeding 4½. However, an earthquake in 1943 with its epicenter in Lake Erie may have had a magnitude as great as 5. The geology of Lake Erie is similar to that of southwest Michigan in that the bedrock is essentially a stable platform with little or no seismic history and no known faulting. Shocks in the Lake Erie area are probably related to glacial rebound, as we believe the shocks to be in the area of the site.

Based on the foregoing, it has been conservatively assumed that the maximum potential earthquake could be as large as Magnitude 5 and might occur relative to some yet unknown geologic structure in the bedrock near the site, perhaps triggered by glacial rebound. Assuming such a shock might have a focal depth as shallow as 10 kilometers, it is estimated that the maximum ground acceleration at foundation level (within the lake or beach sand deposits) at the site would be about 15 percent of gravity. However, additional margin has been provided for by designing the engineered safety features to be

operative under a maximum horizontal ground acceleration of 20 percent of gravity and maximum vertical acceleration of 13.33 percent of gravity.

The seismic design requirements of the containment are given in Chapter 5, and the requirement for other structures and equipment are given in Sub-Chapter 2.9.

Response Spectra

Recommended response spectra showing responses for typical percent of critical damping for the operating basis and the design basis earthquakes, corresponding to horizontal ground accelerations of 10 and 20 percent of gravity, are presented on Figures 2.5-2 and 2.5-3. These response spectra represent the maximum amplitudes of motion in structures having a range of natural frequencies subjected to earthquake ground motion.

The use of the average (El-Centro) response spectra as presented in TID 7024, normalized to the recommended ground accelerations, was deemed appropriate for this site since the average spectra are based on site conditions consisting of a deep thickness of overburden soil over bedrock. The subsurface conditions at the Cook Plant site consists of soils which are comparable in compactness to El-Centro and it was therefore felt that the normalized El-Centro spectra are appropriately conservative for this site.

In order to show that the response spectra generated, using four earthquakes, are as conservative as the spectra generated using a synthetic earthquake, which falls above the site spectra, a comparison was made for the Auxiliary Building, between existing floor spectra and the spectra generated using the modified El-Centro Earthquake (N-S-components - 1934).

The El-Centro earthquake was modified such that at all frequencies its response spectrum falls above the site response spectrum. (See Figure 2.5-3a.)

Figures 2.5-3b thru 2.5-3e show this comparison for various elevations in the structure for an OBE. Curve - A represents the spectrum used in design and curve - B represents the spectrum generated using the synthetic time history motion. Since curve - A envelopes curve - B in all cases the response spectra used in design are conservative.

Figures 2.5-3f thru 2.5-3j show this comparison for the DBE with 5% structural damping.

Supplemental Data

Subsequent to the detailed studies of the site and its surroundings described in the Appendix A, additional work was performed to confirm the validity of the seismic accelerations proposed as design bases for the plant.

An investigation was made of the logs of a series of gas and oil wells drilled in the site vicinity to depths of up to 2500 feet and the results were plotted. Although fifteen logs were studied, eleven lay along a southwest-northeast axis about 35 miles long, roughly parallel to the lake shore and passing about two to three miles from the plant location. The remaining five were located along an axis perpendicular to the first and intersecting it in the site vicinity.

The results of this study demonstrated that there is a complete absence of geologic structure in the immediate site area which could be related to past or future seismic events.

In addition, a large number of references were studied to determine the seismic characteristics of the region surrounding the site. This included eastern Wisconsin, northern Illinois and Indiana, and northwestern Ohio as well as Michigan.

Further information relating to the selection of seismic parameters can be found in the reports of the results of foundation investigations conducted at the site, Appendices E and G to the Preliminary Safety Analysis Report and to the Original Final Safety Analysis Report.

2.5.3 CONCLUSIONS

It is anticipated that the site will not experience any significant earthquake motion during the life of the nuclear facility. Historically, there is no basis for expected ground motion of more than a few percent of gravity. However, as a conservative basis, an earthquake horizontal ground acceleration of 10 percent of gravity was adopted for plant design where applicable.

For safe shutdown of the reactor, and operability of engineered safety features a maximum horizontal ground acceleration of 20 percent of gravity was assumed. This ground acceleration is in excess of that estimated on the basis of an occurrence of a shallow focus Magnitude 5 earthquake close to the site. On the basis of the seismic history and the known tectonics of the area, the possibility of such an occurrence is extremely remote.

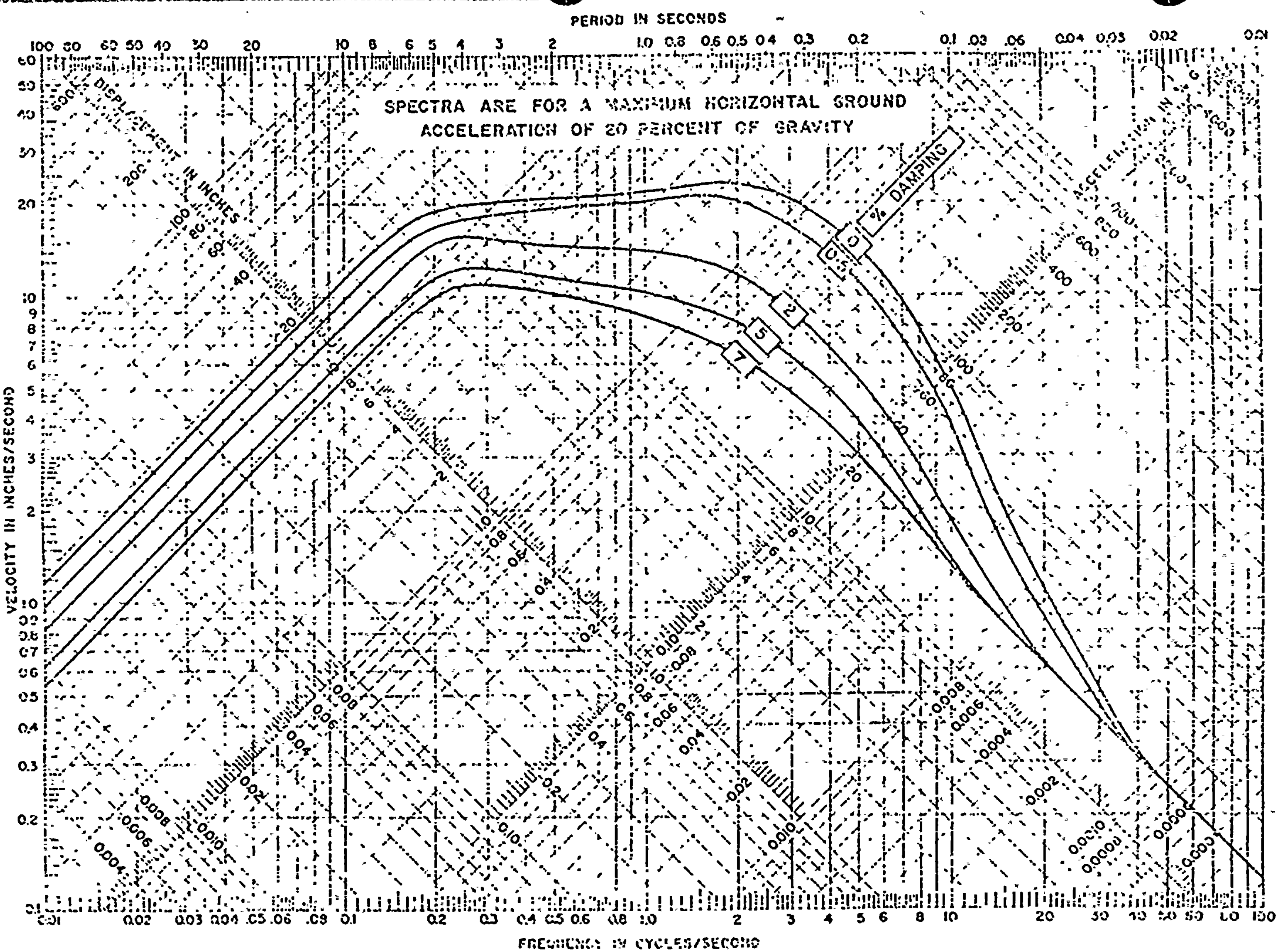
TABLE 2.5-1

EARTHQUAKES WITH EPICENTERS LOCATED WITHIN 200 MILES OF PLANT SITE
(Intensity V or Greater)

Year	Date	Time	Intensity	Location (Remarks)	N. Lat.	W. Long.	Distance From Site (miles)	Felt Area (square miles)
1804	August 24	14:10	VI	Fort Dearborn, Illinois (Chicago)	42.0	87.8	70	30,000
1872	February 6	08:00	V	Weonona, Michigan (three shocks lasting 30 seconds)	43.5	83.8	165	Local
1875	June 18	07:43	VII	Ohio - most severe at Urbana and Sidney	40.2	84.0	185	40,000
1877	August 17	10:50	IV-V	Southeastern Michigan, near Detroit	42.3	83.3	160	200
1882	February 9	14:00	V	Ohio - felt at Swandors and Bodkins, near Anna	40.5	84	165	
1883	February 4	05:00	VI	Indiana and Michigan, felt at Kalamazoo, Michigan (possibly invalid - see page 2.5-1)	42.3	85.6	50	8,000
1884	September 19	14:14	V	near Lima, Ohio	40.7	84.1	155	125,000

TABLE 2.5-1 (cont'd.)

Year	Date	Time	Intensity	Location (Remarks)	N. Lat.	W. Long.	Distance From Site (miles)	Felt Area (square miles)
1909	May 26	08:42	VII	Northern Illinois	42.5	89.0	135	500,000
1912	January 2	10:21	VI	Northern Illinois	41.5	88.5	115	40,000
1929	March 8	04:06	V	near Bellefontaine, Ohio	40.4	84.2	165	5,000
1930	September 30	14:40	VII	Ohio, strongest at Anna	40.3	84.3	165	-
1931	September 20	17:05	VII	Ohio, felt at Anna, Sidney and Houston	40.2	84.3	175	40,000
1937	March 2	09:48	VII	Western Ohio, maximum intensity at Anna and Sidney	40.7	84.0	160	90,000
	March 3	03:50	V	Ohio, felt at Sidney, Anna, Jackson Center and Botkins	40.50	84	165	-
	March 8	23:45	VII-VIII	Western Ohio, near Anna	40.6	84.0	165	150,000
1947	May 6	15:25	V	Milwaukee, Wisconsin	43	88	90	3,000
	August 9	20:47	VI	South Central Michigan	42.0	85.0	75	50,000
1956	January 27	06:03	V	West Central Ohio	40.50	84	165	-
1961	February 22	03:45	V	North Western Ohio, felt at Amsden and Arcadia	41.2	83.4	170	-

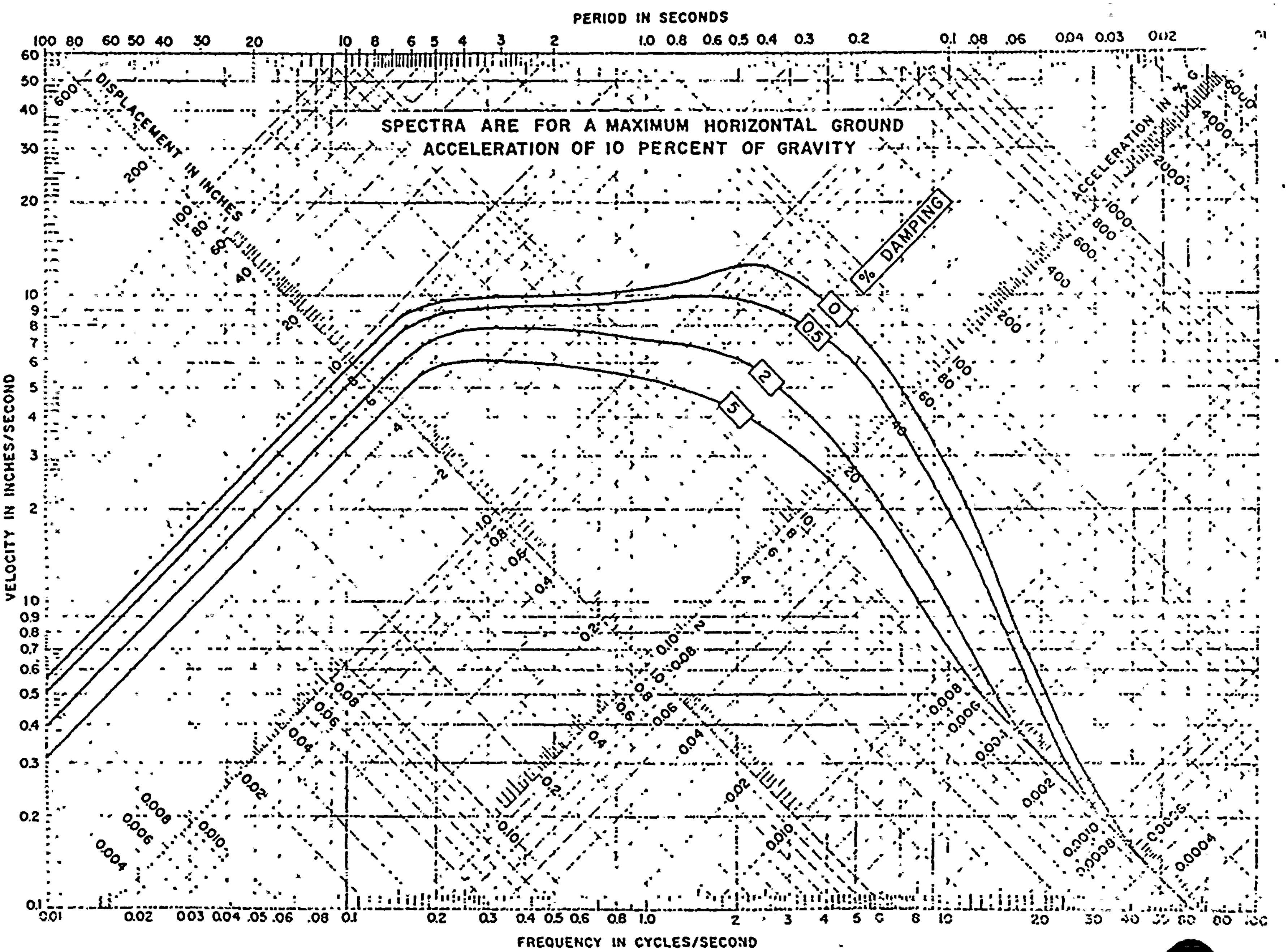


RECOMMENDED RESPONSE SPECTRA

DESIGN BASIS EARTHQUAKE

July, 1982

FIGURE 2.5-3



RECOMMENDED RESPONSE SPECTRA

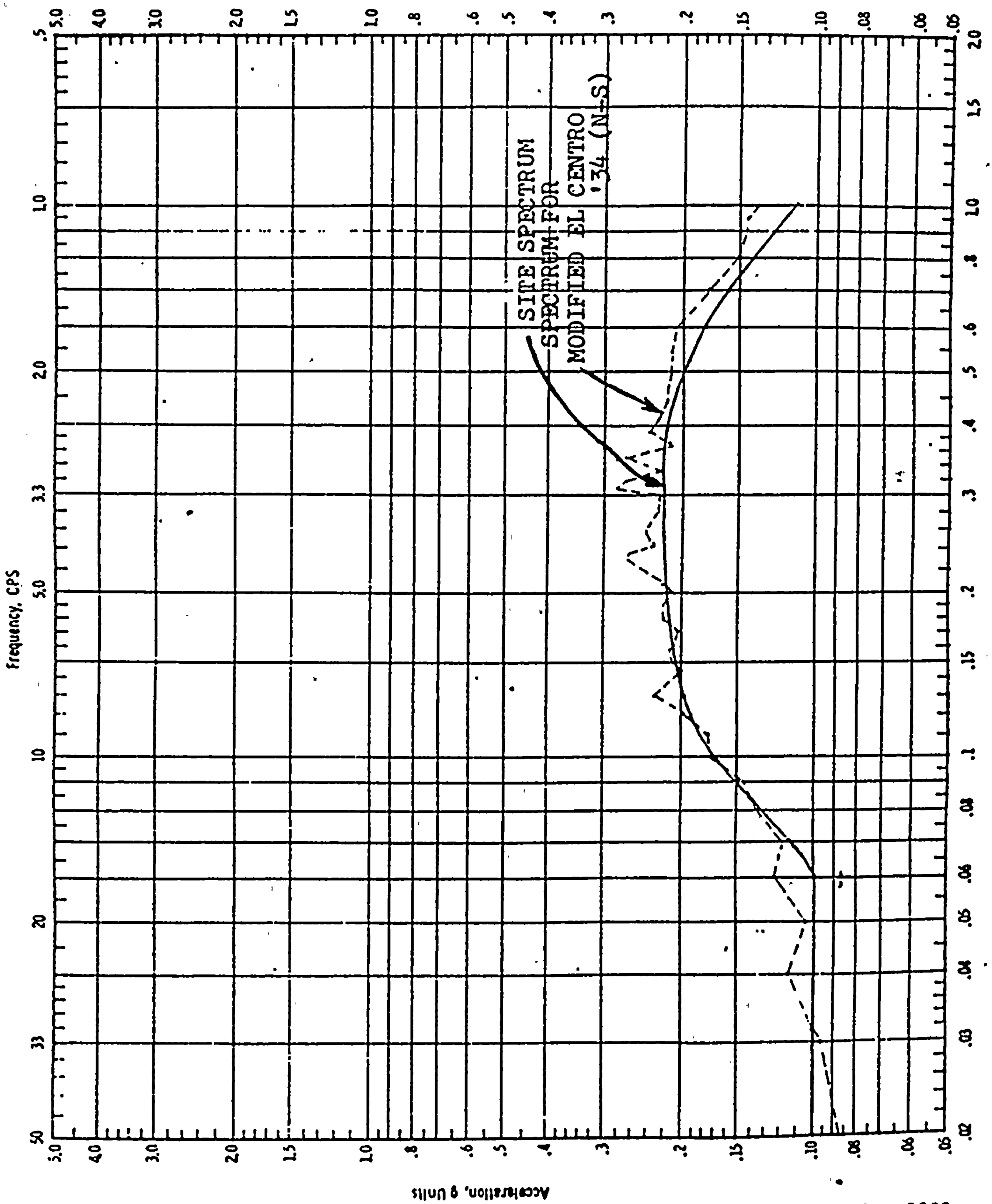
OPERATING BASIS EARTHQUAKE

FIGURE 2.5-2

July, 1982

DAMES & MOORE

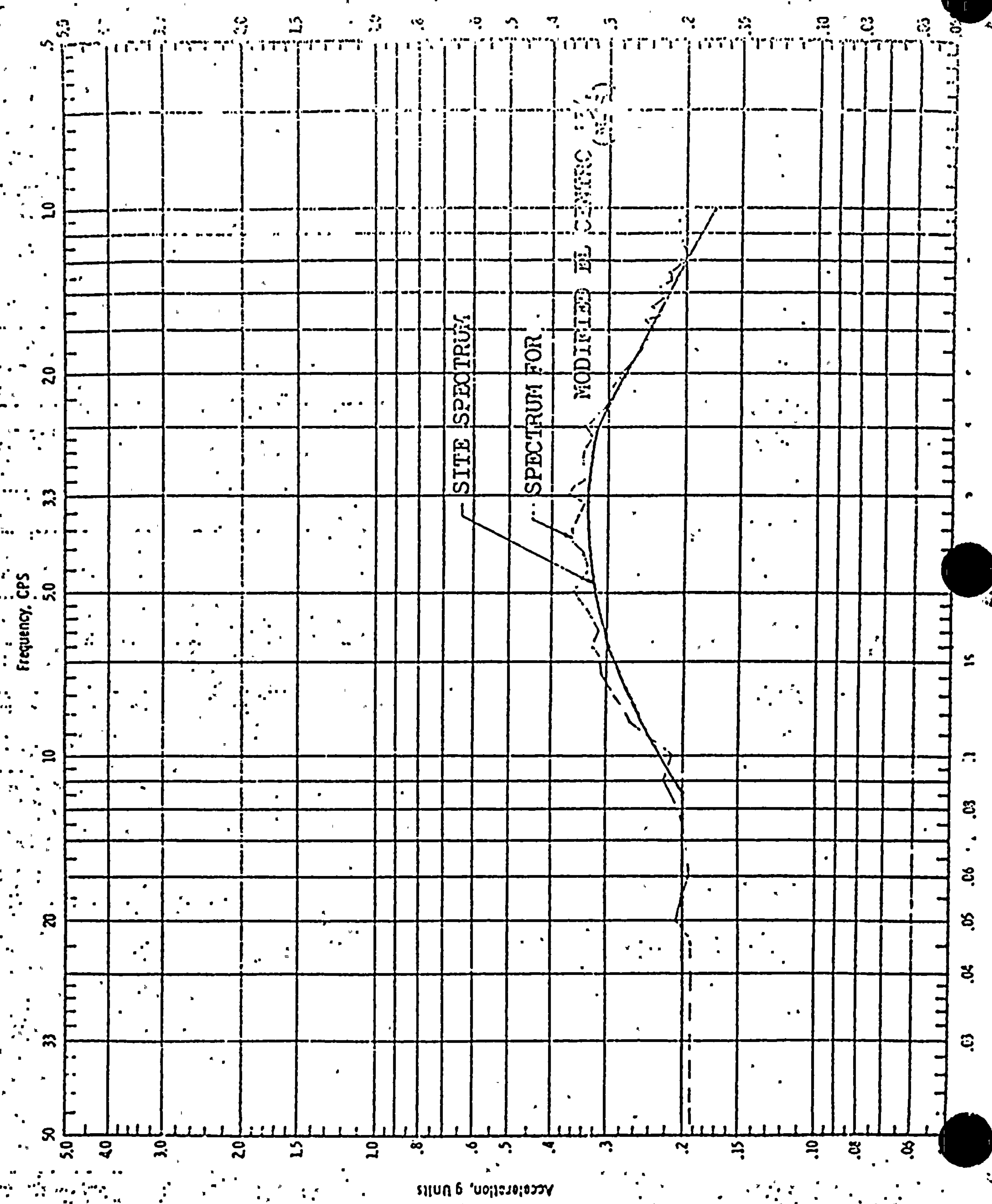
SARGENT & LUNDY ENGINEERS	
CLIENT	AEP SERVICE CORPORATION
PROJECT	D.C. COOK — JOB NO. 4210
DESIGN BY	SGM — DATE OCTOBER 12, 1972
CHECKED BY	HHS — DATE " — SHEET ___ OF ___



July, 1982

Figure 2.5-3a SITE SPECTRA V.S. MODIFIED EL CENTRO '34
OPERATING BASIS EARTHQUAKE
(2% DAMPING)

PROJECT ____ JOB NO. ____
DATE 12-21-72
CHECKED BY ____ DATE 12-21-72 SHEET ____



SITE SPECTRA VS. MODIFIED EL CENTRO '34
DESIGN BASIS EARTHQUAKE
(5% DAMPING)

Figure 2.5-3f

July, 1982