UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555
July 9, 1981

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file

Docket No. 50-244
LS05-81- 07-014

RECEIVED
JUL 10 1981
U.S. NUCLEAR REGULATORY COMMISSION

Mr. John E. Maier, Vice President
Rochester Gas & Electric Corporation
89 East Avenue
Rochester, New York 14649

Dear Mr. Maier:

SUBJECT: SEP REVIEW TOPICS II-4, GEOLOGY AND SEISMOLOGY AND II-4.B, PROXIMITY OF CAPABLE TECTONIC STRUCTURES IN PLANT VICINITY

Enclosed is a copy of our evaluation for Systematic Evaluation Program Topics II-4, "Geology and Seismology," and II-4.B, "Proximity of Capable Tectonic Structures in Plant Vicinity." These assessments compare your site condition, as described in the docket and references with the criteria currently used by the staff for licensing new facilities. Please inform us if your site condition differs from the licensing basis assumed in our assessments.

Our review of these topics is complete and this evaluation will be a basic input to the integrated safety assessment for your facility unless you identify changes needed to reflect the existing site condition at your facility. These topic assessments may be revised in the future if NRC criteria relating to these topics are modified before the integrated assessment is completed.

Sincerely,

Walter A. Paulson

for Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

SE04
S1/1

DSU USE EX(07)

8107130397 p

Mr. John E. Maier

cc
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SEP SAFETY TOPIC EVALUATION

R. E. GINNA NUCLEAR POWER PLANT

TOPIC II-4, GEOLOGY AND SEISMOLOGY

Introduction

During the time frame when SEP plants were designed, the licensees, because compliance with Regulatory Guide 1.70 was not required, usually provided only very minimal information in geologic and seismologic areas. Therefore, in order to assess the adequacy of the design of these older plants with respect to local geologic and seismologic phenomena, a re-review was necessary. The scope of this topic review included surface faulting, potential landslides, ground collapse, possibility of liquefaction, etc.

Review Criteria

1. Standard Review Plan Sections 2.5.1, 2.5.2, 2.5.3, 2.5.4 and 2.5.5
2. Appendix A to 10 CFR Part 100

Related Safety Topics and Interfaces

The related safety topics are II-4.A, II-4.B, and II-4.C. The conclusion from each of these sub-topics form a part of the overall conclusion for this topic, i.e., site specific ground response spectrum for this site.

Evaluation

The geology and seismology of the Ginna site were first reviewed in 1965 and 1966 by the Atomic Energy Commission (AEC) and its advisors, the U. S. Geological Survey (USGS) and the Environmental Science Services Administration (ESSA) of the Coast and Geodetic Survey. In its report the USGS concluded that a relationship between seismicity and mapped faults had not been demon-

strated within the area. The ESSA concluded after its review of the regional seismicity that the plant should be designed for a moderately strong earthquake having an acceleration of approximately 0.20g without loss of function of components important to safety.

Recently, as a part of the SEP, a re-review of the seismological hazard at the Ginna site was conducted through the Site Specific Spectra Program for the Eastern United States SEP facilities. The current recommendation for the seismic input ground motion was transmitted to the SEP Owners in a letter from D. M. Crutchfield, dated June 17, 1981. In Attachment 2 to the letter, a memo from the Geosciences Branch, Division of Engineering, entitled, "Final Review and Recommendations for Site Specific Spectra at SEP Sites," the following conclusion was drawn:

> "Based upon our ongoing review of site geology to satisfy SEP Topics II-4: Geology and Seismology, and II-4.B; Proximity of Capable Structures to the Site, we do not anticipate that our final review of these topics will have any impact upon the recommended spectra."

The geology of the site was re-assessed by the AEC staff when Rochester Gas & Electric Corporation (RG&E) applied for a full term license in August 1972. At that time RG&E reported the discovery of faults adjacent to Ginna during investigations for an alternate site for its Sterling Power Project. We reviewed the available data concerning these faults and concluded that they were not capable within the meaning of Appendix A, 10 CFR Part 100.

Other new information that we became aware of since the CP review was the existence of relatively high residual stresses in bedrock in the Lake Ontario region (Fitzpatrick PSAR and FSAR, Sbar and Sykes, 1973, and Dames and Moore,

1978, Nine Mile Point Geologic Investigations). We have reviewed the available data and conclude that if such stresses were present at the Ginna site they were most likely relieved during excavation and construction and do not represent a problem to the plant. In response to staff questions RG&E confirmed that during the life of the plant there have been no occurrences such as cracked walls or foundations that can be attributed to high stresses in bedrock.

During the SEP geological review of the Ginna site the staff reviewed the following materials: the Ginna PSAR, SER, Dames and Moore Geological and Geophysical Investigations Ginna Site, Dames and Moore Geologic Investigations Nine Mile Point Unit 2, aerial photographs, topograhic maps, and selected documents from the open literature (a list of references is at the end of this chapter).

The following paragraphs present a brief description of the regional and site geology.

The site is located on the southern shore of Lake Ontario in the eastern portion of the Erie-Ontario Lowlands Physiographic Province (Fenneman, 1938). The regional topography is of low relief and rises gradually from an elevation of +250 msl at the lake to +500 at the Portage Escarpment which is the northern boundary of the Appalachian Plateau Province to the south. A beach ridge 10 to 25 feet high parallels the shoreline of Lake Ontario 4 miles to the south. North of the ridge is the lake plain of former glacial Lake Iroquois. The site lies on this plain.

The southern margin of Lake Ontario is characterized by many promontories which seem to reflect prominent joint directions in bedrock. The site is located

near one such promontory called Smokey Point. Major joint directions are N 75° to 85°E and N10°E to 30°W. Erosional bluffs along the lake range from 15 to 30 feet high. Smokey Point is located at the eastern end of a 5 mile long ridge, the crest of which is about +310'. Relief in the site area is low with elevations ranging from +360 to +300. The site is underlain by 20 to 60 feet of glacial deposits, and approximately 2700 feet of Paleozoic (570 million years before present mybp to 225 mybp) sedimentary rocks over crystalline basement. The uppermost Paleozoic unit is sandstone of upper Ordovician (455 to 430 mybp) Queenston Formation.

The glacial deposits include at least two till horizons. The lower unit overlies bedrock and varies in thickness from 6 to 25 feet. This unit consists of grayish red, calcarous, silty clay. The unit is poorly sorted and contains numerous striated and faceted pebbles, cobbles and boulders. The upper till unit is at or near the ground surface and ranges from 7 to 30 feet in thickness. This unit is composed of relatively uniform olive gray to yellow brown silty, sandy clay, with large boulders several feet in diameter. Between the two till horizons is a zone of lakebed deposits consisting of gray, very plastic clay.

RG&E has determined by regional correlation that the lower till unit is associated with the Woodfordian glacial advance, a substage of the Wisconsinan Stage, which took place about 22,000 years ago. The lakebed deposit is believed to have been deposited in the bed of Lake Iroquois. The upper till is related to a minor glacial readvancement that occurred about 12,000 years ago. The staff has examined the evidence and agrees with the licensee's interpretation.

Conclusion

Based on the information provided in the references, the acceptable conclusions of Topics II-4.A, II-4.B, and II-4.C and the evaluation stated above, we conclude that the information used for developing site specific spectra is adequate and have re-affirmed that local geologic and seismologic phenomena will not affect the plant.

REFERENCES

Dames and Moore, 1978, Nine Mile Point Nuclear Station, Unit 2 Geologic Investigations, for Niagara Mohawk Power Corporation.

Dames and Moore, 1974, Geologic and Geophysical Investigations Ginna Site, Ontario, New York, for Rochester Gas and Electric Corp.

Dames and Moore, 1965, Site Evaluation Study, Proposed Brookwood Nuclear Power Plant, Ontario, New York, Rochester Gas and Electric Corp.

Environmental Science Services Administration, 1966 Report on the Seismicity of the Rochester, New York Area, 16 Feb. 1966 letter to H. L. Price, USAEC from J. C. Tilson, ESSA.

Fakundiny, R.H., P.W. Pomeroy, J. W. Pferd, T. A. Nowak, Jr., and J. C. Meyer, 1978, Structural Instability Features in the Vicinity of the Clarendon Linden Fault System, Western New York and Lake Ontario, New York State Mes/um

Fenneman, N.M., 1938, Physiography of Eastern United States, McGraw Hill Book Co., New York, 534 pp.

Flint, R.F., 1971, Glacial and Quaternary Geology, John Wiley and Sons, Inc., New York 892 pp.

New York State Electric and Gas Corporation, 1979, Preliminary Safety Analysis Report New Haven Nuclear Site, Appendix 2.5.

Power Authority State of New York, 1972, James A. Fitzpatrick Nuclear Power Plant Final Safety Analysis Report.

Rochester Gas and Electric Corporation, Robert Emmett Ginna Nuclear Power Plant Unit NO. 1. Final Facility Description and Safety Analysis Report.

Sbar, M.L. and L. R. Sykes, 1973, Contemporary Compressive Stress and Seismicity in Eastern North America: An Example of Intra-plate Tectonics, Geol. Soc. Amer. Bull. vol. 84, pp. 1861-1882.

Stone and Webster, 1978, Report of Fault Investigations at Fitzpatrick Nuclear Power Plant, for Power Authority of the State of New York.

U. S. Geological Survey, 1966, Geology and Hydrology of the Proposed Brookwood Nuclear Station No. 1 site, Wayne County, New York, 28 Feb., 1966 letter to H. L. Price, USAEC from the Acting Director USGS.

SEP SAFETY TOPIC EVALUATION

R. E. GINNA NUCLEAR POWER PLANT

TOPIC II-4.B, Proximity of Capable Tectonic Structures in Plant Vicinity

Introduction

In order to assure that the local geological features and the expected ground shaking characteristics will not endanger the safety of plant facilities, an evaluation should be made on the characteristics of local geological features. The scope of this topic evaluation is to review the existing information provided by licensee and to identify new features such as capable faults, etc.

Review Criteria

1. Standard Review Plan Section 2.5.2
2. Appendix A to 10 CFR Part 100

Related Safety Topics and Interfaces

The related safety topics are II-4, II-4.A and II-4.C. The results of this review topic may affect the conclusion drawn for these related topics, i.e., site specific ground response spectra developed for the SEP plants.

Evaluation

Within the Ontario Lowlands the nearest regional faulting is the Clarendon-Linden structure near Batavia, New York. The structure trends north-south and is about 35 miles west of Ginna. The fault is described (Fakundiny et al, 1978) as a complex faulted zone with major north-south set of subparallel normal and reverse faults that have a cumulative displacement of approximately 100 meters with east side up. Data suggests that the zone is continuous to the north across Lake Ontario for a total length of as much as 180 km.

Fakundiny et al (1978) found no unequivocal evidence of post glacial faulting among 36 faults, 6716 joints and 87 pop-ups studied around the Clarendon-Linden fault system. However, numerous earthquakes, including the 1929 Modified Mercalli Intensity VIII earthquake, have occurred within the fault system near Attica. A number of seismologists have concluded that these events are probably related to solution mining of salt.

The presence faults has been documented at the Nine Mile Point and Fitzpatrick nuclear sites approximately 50 miles east of Ginna. The structures are three west-northwest striking high angle faults, and several north-south striking thrust faults and folds. Displacements range from inches to several feet. Several of the faults mapped at Nine Mile Point, Unit 2 have been shown to have undergone some movement during the last 10,000 years. Although the NRC staff has not completed its review of these faults we have tentatively concluded that the most recent displacements are most likely associated with the complex phenomena caused by glacial loading and unloading. However, no such post Pleistocene faults have been identified at Ginna.

A structural complex was also discovered at the proposed New Haven site located a few miles east of Nine Mile Point. These structures consist of a large northeast striking anticline with several associated faults. The folds and faults were demonstrated by the applicant to be non capable within the intent of Appendix A (NYSE&G 1 and 2 PSAR).

Several minor normal faults with 2 to 15 feet of displacements have been identified between the site and northward projection of the Clarendon-Linden fault. There is no evidence that indicates post Pleistocene (less than 10 mybp) movement along these faults.

During an investigation conducted by Rochester Gas and Electric Company (RGE) in 1973 adjacent to the Ginna Nuclear site for an alternate site for the Sterling Power Project, evidence of faults was found in core borings. An extensive investigation program was carried out. The investigations included a large trench excavated across the fault zone, additional borings, petrofabric and minerological analyses, testing of samples from the fault zones, geophysical explorations, and surface geological mapping.

The studies revealed that the fault zone was comprised of three down-to-the-northeast faults that trended N65^{o}W. The maximum offset is about 26 feet which decreases to about 6 feet to the southeast near the plant. The fault zone passes about 30 feet southwest of the Reactor complex. Three geological reconaissanceswere made by a staff geologist to the site to review progress of the investigations and examine features exposed in trenches across the fault zone.

A large trench across the fault revealed extensive deformation of glacially deposited horizons but there was no deformation that was directly attributable to tectonc movement along the faults.

The strongest evidence that these deformations are not related to tectonic displacement on the bedrock faults is the presence of a horizontal unit at the base of the lower till which lies undisturbed across the southernmost fault, and stacking planes (imbricate thrust sheets caused by the southward advancement of the glacier) that cut across the faults without displacements.

RG&E also attempted to determine the age of fault gouge by radiometric techniques, but the results were unreliable. However, other lines of evidence indicate a much older age of last movement than Pleistocene. This evidence includes:

(1) the observation that the contemporary stress field is different from that in which the fault originated. According to Sbar and Sykes, 1973 the contemporary stress picture in Western New York is one of nearly horizontal compression oriented in an eastwest direction. Evidence for this is local squeeze and pop-up features and in-situ stress measurements in the region. The existing stress field is not consistent either in orientation or type of stress field in which the faults were formed, and the stress regime in which the faults were formed was essentially northeast-southwest and tensional.

(2) The presence of unsheared hydrothermal crystals within the fault zone demonstrate that faulting predates the hydrothermal event which deposited the crystals and this event probably occurred no later than the Cretaceous (65 million years ago). Analyses carried out by consultants to RG&E show that the mineralization of fluid inclusions in calcite crystals along with sulfide mineralization, particularly pyrrhotite and molybdenite, more than likely reflect hydrothermal mineralization at temperatures of at least 225° to $300^{o}C$. The last known tectonic environment within which such conditions could have developed in the area was about 65 million years ago.

(3) No recorded historic earthquake has occurred which could be associated with the faults.

We therefore conclude that the faults at least predate the latest major glacial advance which occurred about 22,000 years ago. The weight of all the available information indicates that the faults are more than 65 million years old.

Construction photographs of the Ginna excavation were examined by the staff. There were ample fair quality photos to cover most of the walls of the major excavation. Bedrock bedding could be clearly seen in many of the photographs, and, although there are numerous joints, there is no indication of displacement. We therefore, can conclude that there is no faulting directly beneath the major Category I structures of the plant.

Conclusion

Based on the information by the licensee and the analysis described above, we conclude that there are no capable faults in the vicinity of Ginna site, and that conclusions made during licensing reviews are still valid.

REFERENCES

Dames and Moore, 1978, Nine Mile Point Nuclear Station, Unit 2 Geologic Investigations, for Niagara Mohawk Power Corporation.

Dames and Moore, 1974, Geologic and Geophysical Investigations Ginna Site, Ontario, New York, for Rochester Gas and Electric Corp.

Dames and Moore, 1965, Site Evaluation Study, Proposed Brookwood Nuclear Power Plant, Ontario, New York, Rochester Gas and Electric Corp.

Environmental Science Services Administration, 1966 Report on the Seismicity of the Rochester, New York Area, 16 Feb. 1966 letter to H. L. Price, USAEC from J. C. Tilson, ESSA.

Fakundiny, R.H., P.W. Pomeroy, J. W. Pferd, T. A. Nowak, Jr., and J. C. Meyer, 1978, Structural Instability Features in the Vicinity of the Clarendon Linden Fault System, Western New York and Lake Ontario, New York State Museum.

Fenneman, N.M., 1938, Physiography of Eastern United States, McGraw Hill Book Co., New York, 534 pp.

Flint, R.F., 1971, Glacial and Quaternary Geology, John Wiley and Sons, Inc., New York 892 pp.

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Stone and Webster, 1978, Report of Fault Investigations at Fitzpatrick Nuclear Power Plant, for Power Authority of the State of New York.

U. S. Geological Survey, 1966, Geology and Hydrology of the Proposed Brookwood Nuclear Station No. 1 site, Wayne County, New York, 28 Feb., 1966 letter to H. L. Price, USAEC from the Acting Director USGS.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUN 0 8 1981

T Cheng

LETTER TO ALL SEP OWNERS
(EXCEPT SAN ONOFRE)

Gentlemen:

SUBJECT: SITE SPECIFIC GROUND RESPONSE SPECTRA FOR SEP PLANTS LOCATED IN THE EASTERN UNITED STATES

Reference: Letter to SEP Group II Plant (Big Rock Point, Dresden 1, Haddam Neck, La Crosse, Yankee Rowe) Licensees from D.G. Eisenhut, NRC dated August 4, 1980

Our letter dated August 4, 1980 (reference) issued the preliminary version of site specific ground response spectra for the eastern United States SEP plants. Recently, these spectra have been finalized by the staff. Enclosure 1 includes the recommended ground response spectra (5% damping) for the eastern SEP sites. The bases of our final decision regarding the spectra and the digitized spectral acceleration values (5% damping) for these spectra are documented in Enclosure 2.

The site specific spectra (SSS) included in Enclosure 1 establish the ground motion acceleration values to be input into the structural reevaluation analyses to determine the resultant seismic loads. The geology reviews for Palisades, Ginna and Dresden 2 have been completed by the staff. The results of the review did not identify any geologic features that would affect the site specific spectra for those facilities. Based on our review to date for the remainder of the SEP facilities located in the eastern United States, we do not expect the SSS to be changed due to local geologic considerations.

Sincerely,

Dennis M. Crutchfield

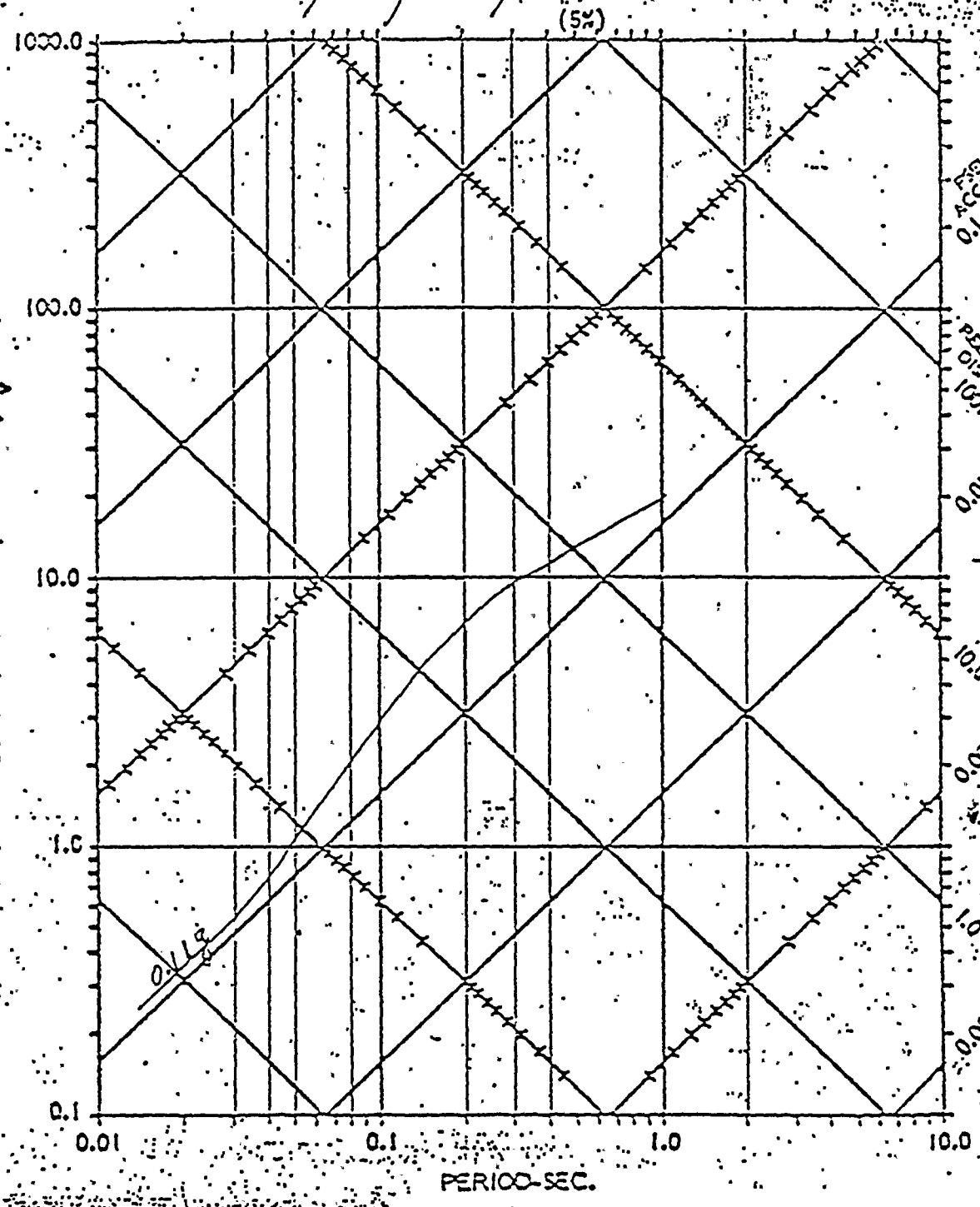
Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

cc:
D. Eisenhut
J. Knight
G. Lainas
R. Jackson
G. Lear
W. Russell
R. Hermann
T. Cheng
P.Y. Chen

Attachment I

Site Specific Spectrum

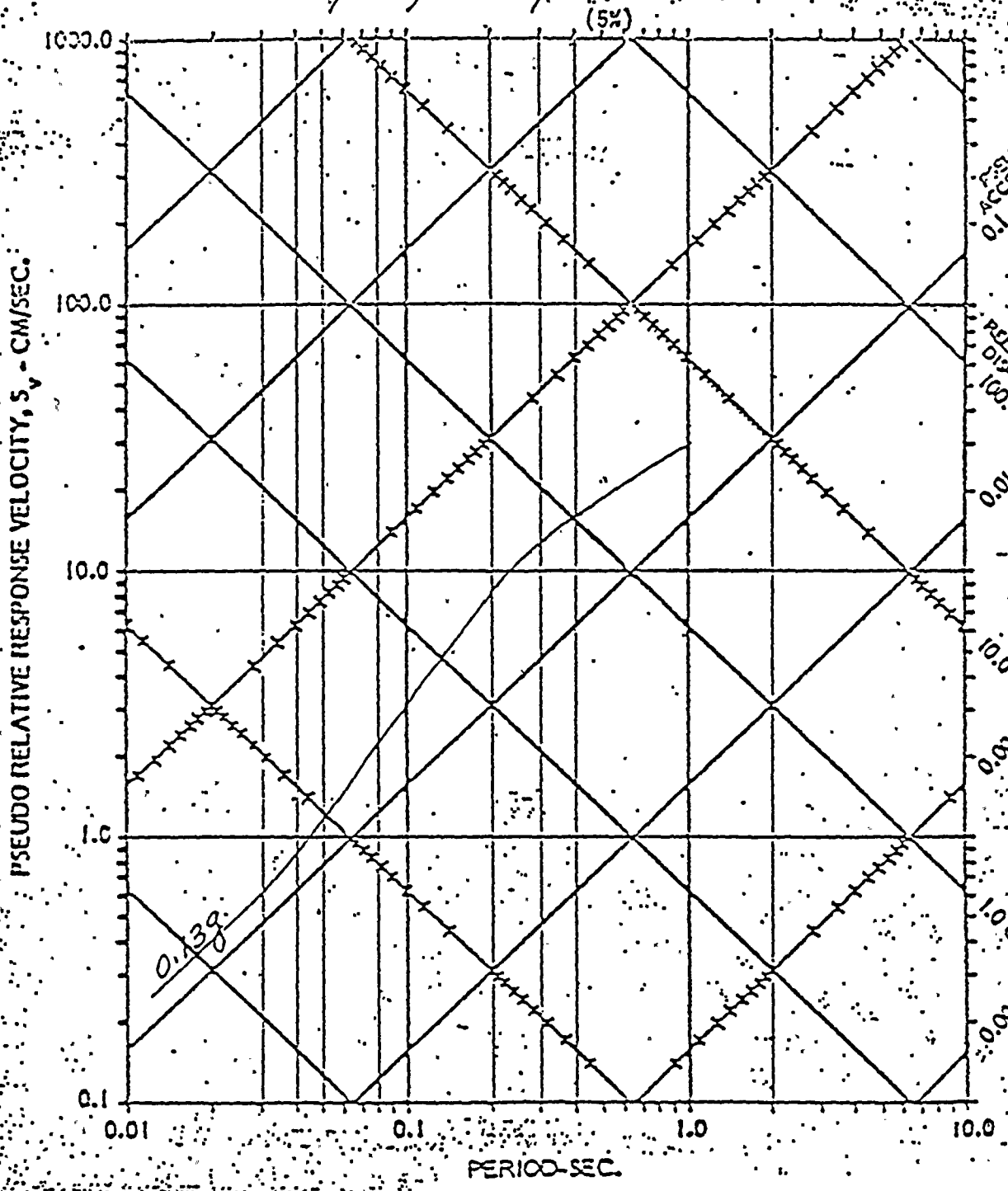


Big Rock Point Site

(5% Damping)

Attachment 1

Site Specific Spectrum

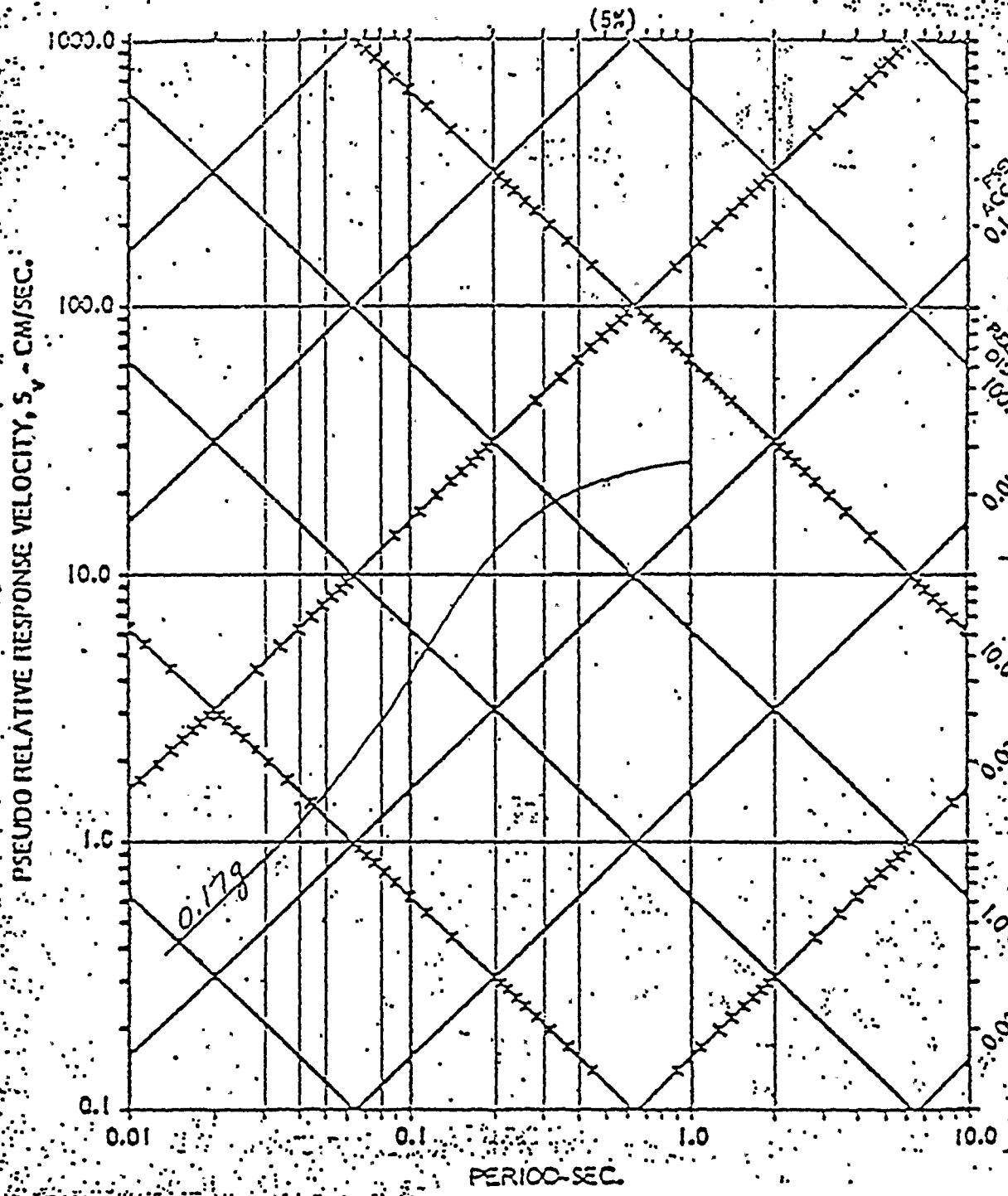


Dresden Site

(5% Damping)

Attachment 1

Site Specific Spectrum

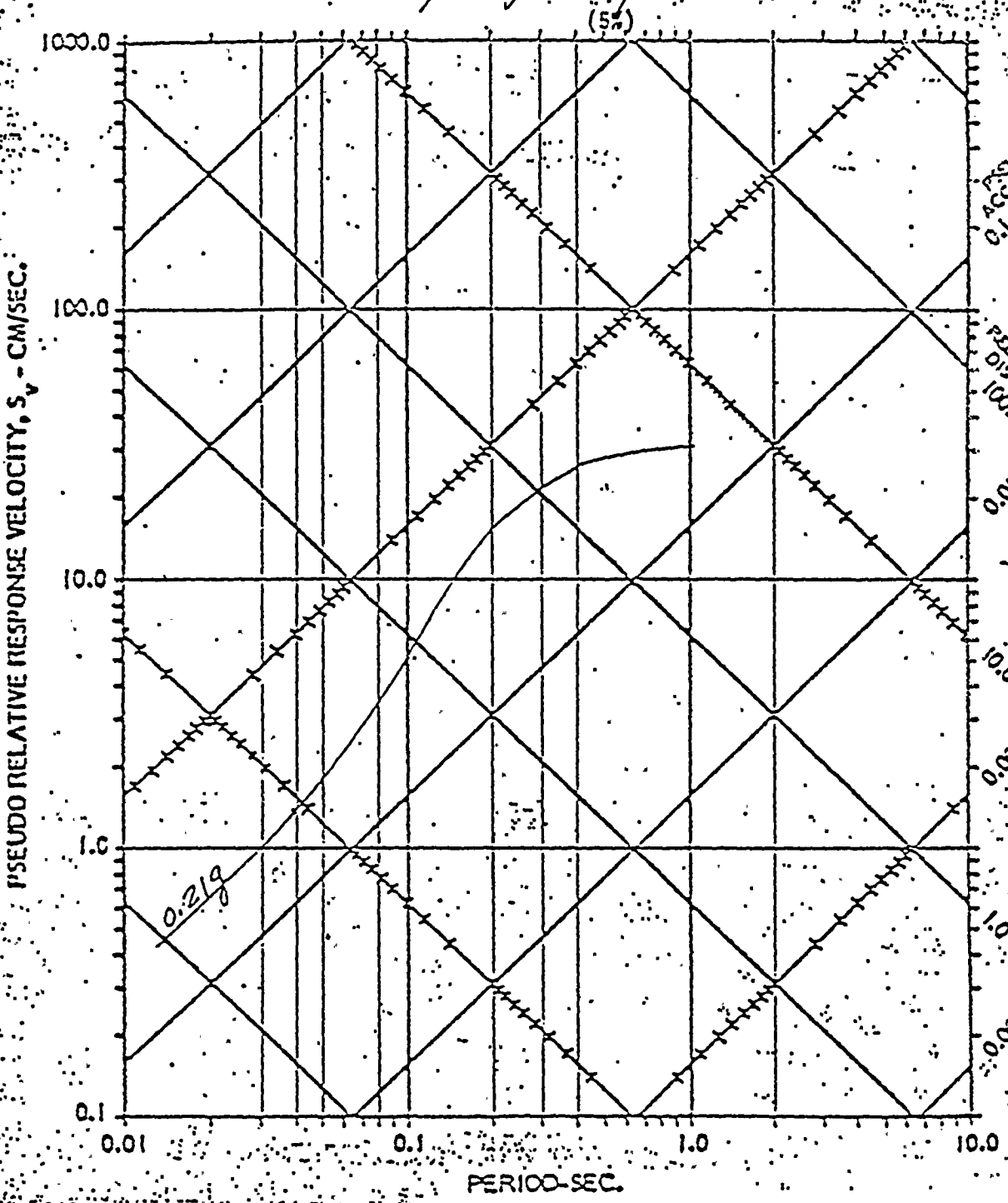


Ginna Site

(5% Damping)

Attachment 1

Site Specific Spectrum

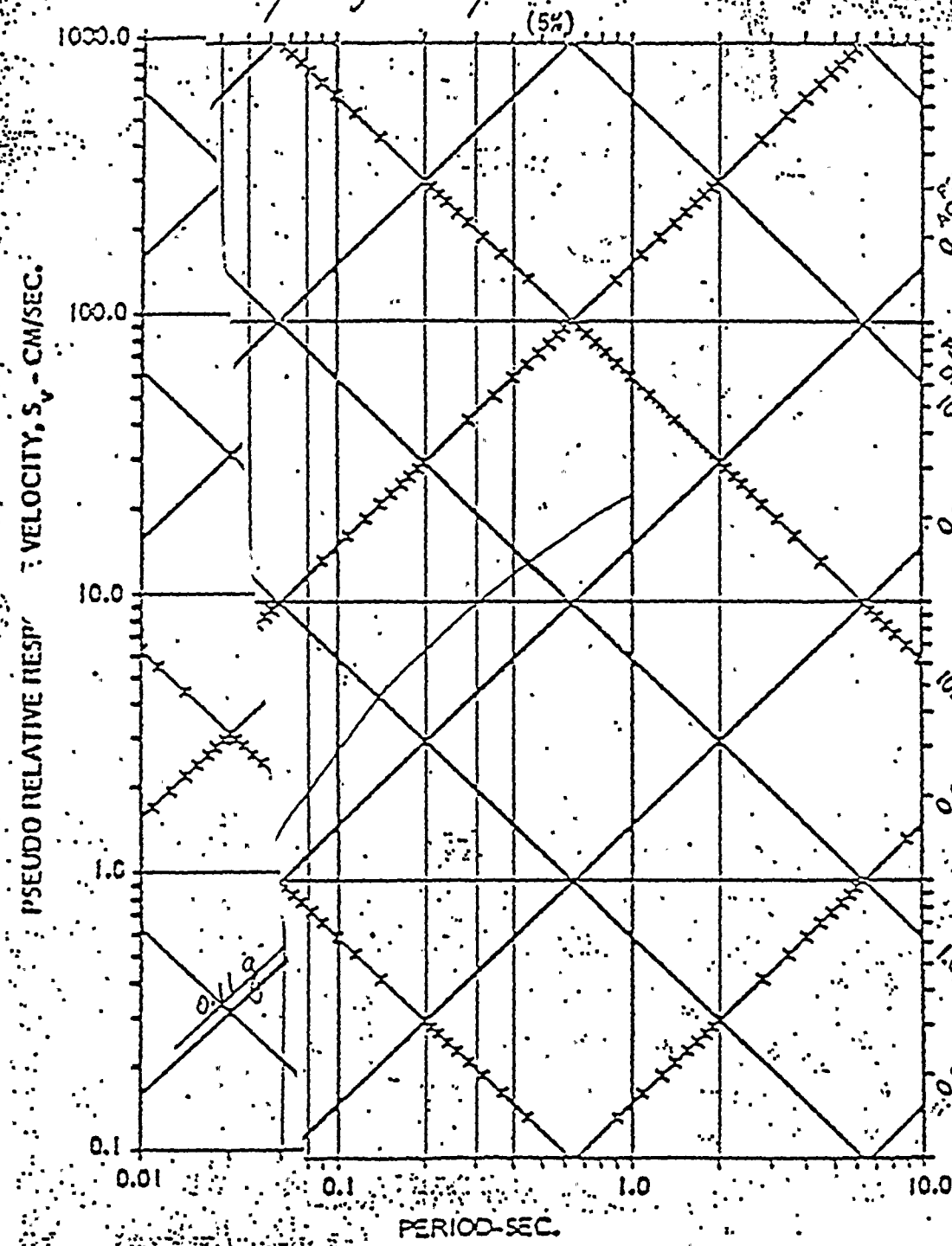


Haddam Neck Site

(5% Damping)

Attachment I

Site Specific Spectrum

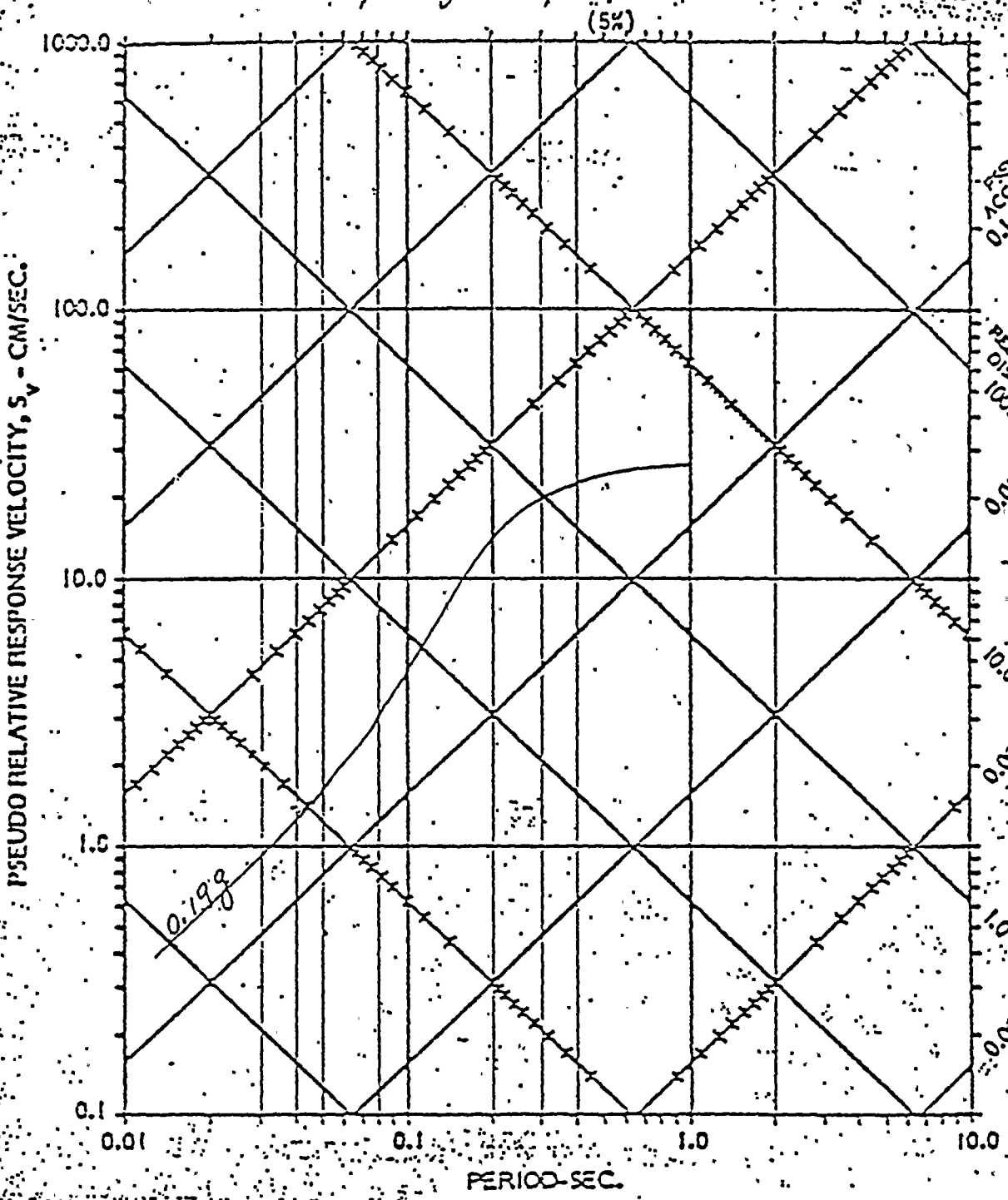


La Crosse Site

(5% Damping)

Attachment I

Site Specific Spectrum

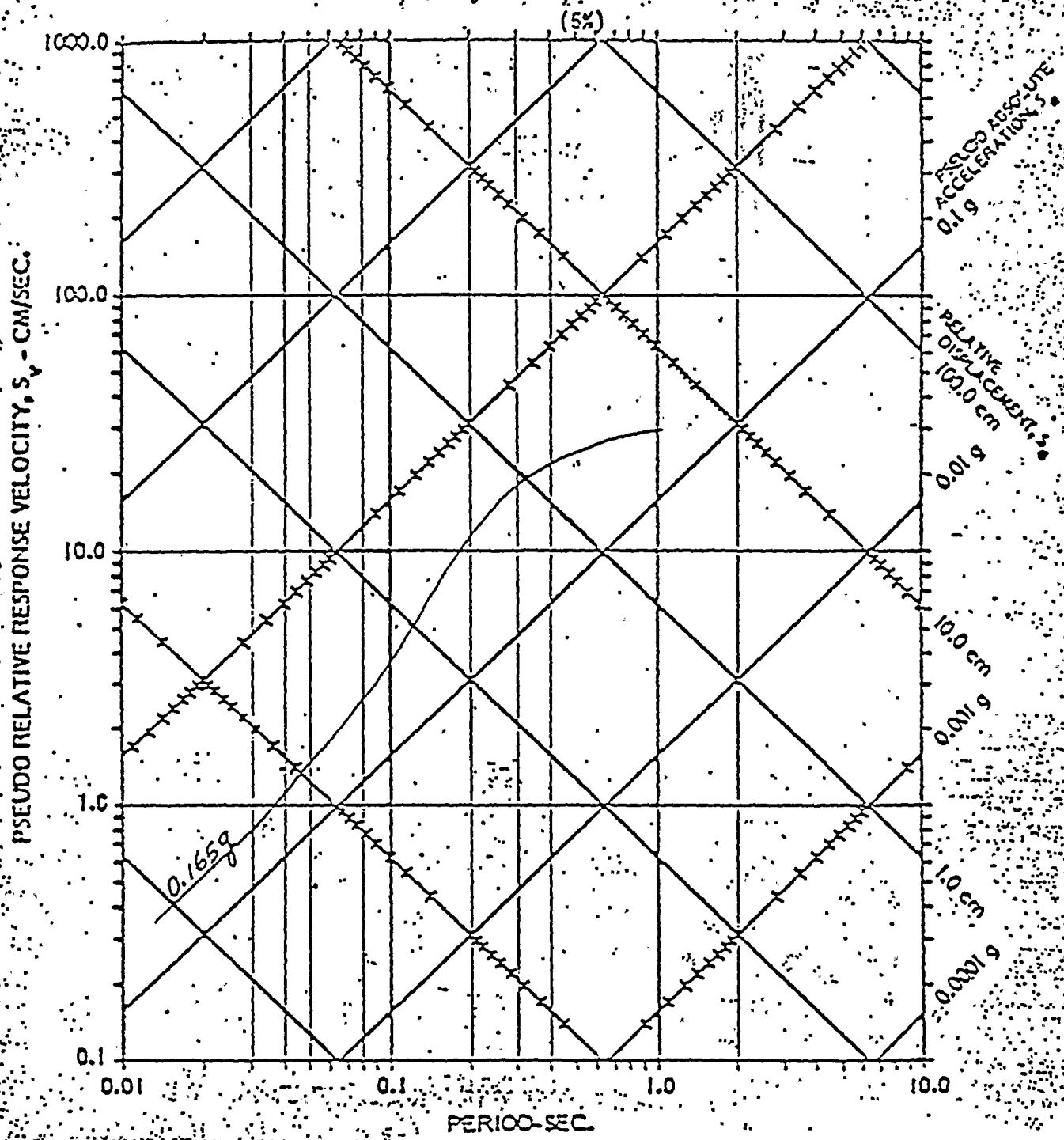


Millstone I Site

(5% Damping)

Attachment 1

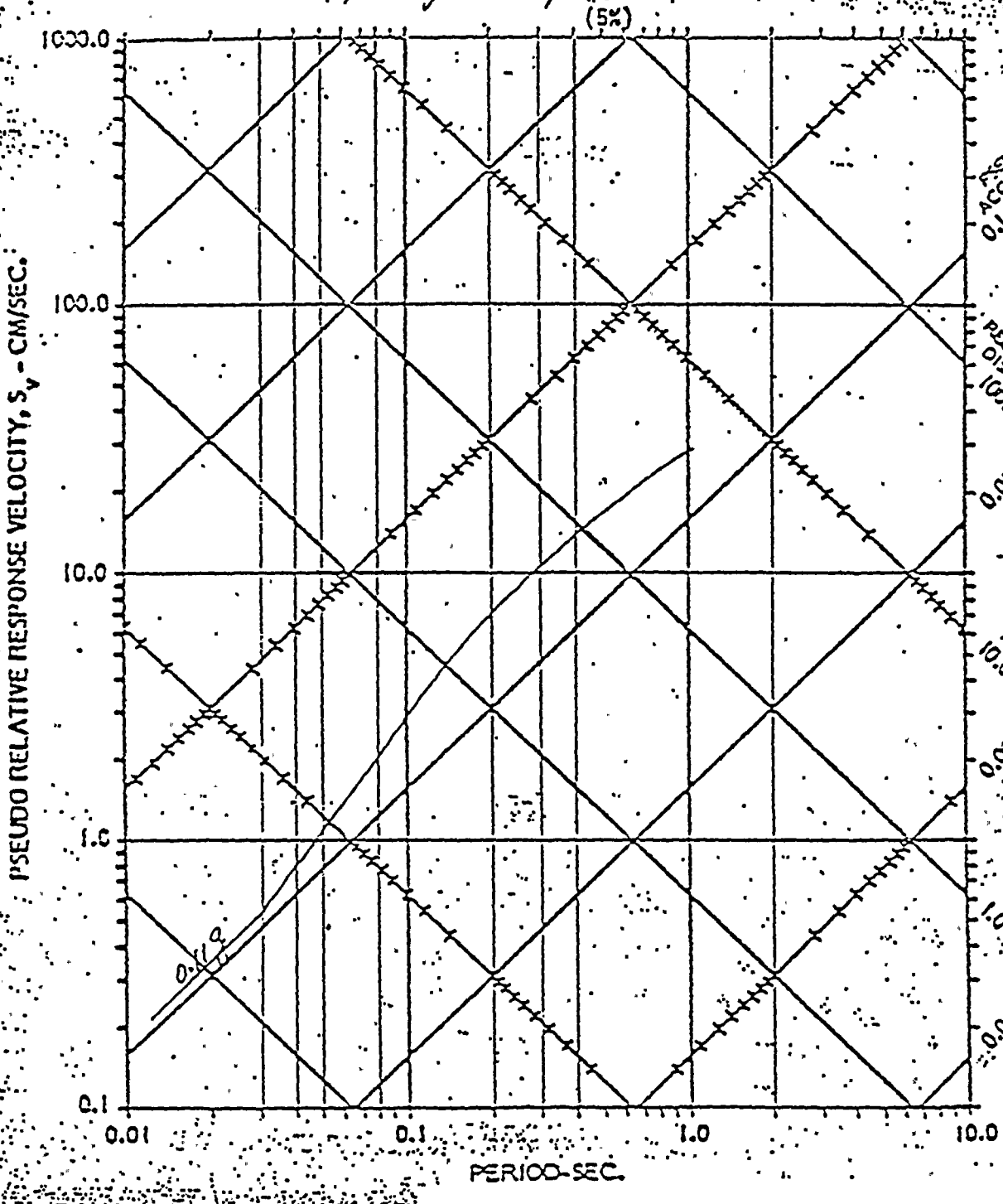
Site Specific Spectrum



Oyster Creek Site
(5% Damping)

Attachment 1

Site Specific Spectrum

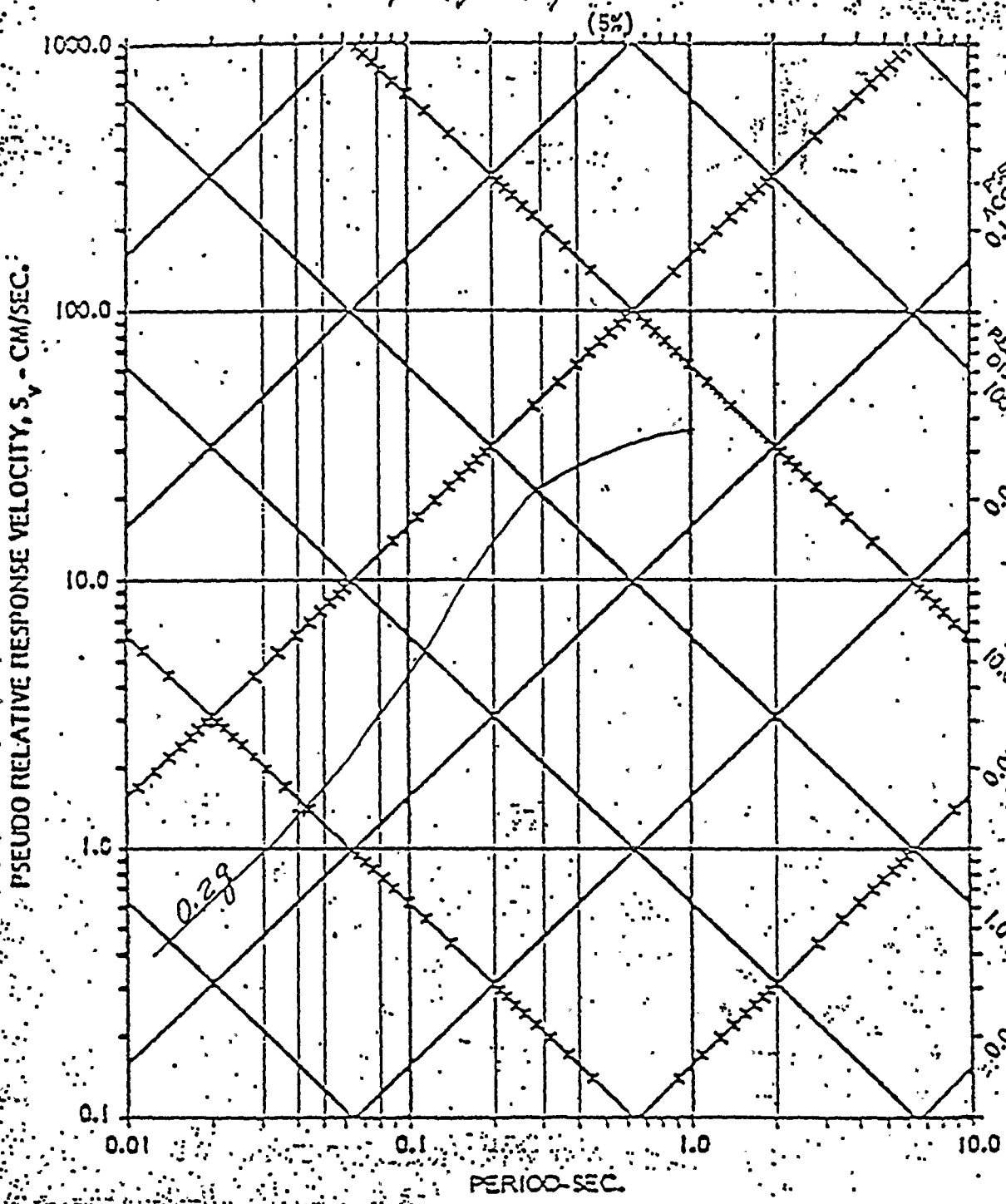


Palisades Site

(5% Damping)

Attachment 1

Site Specific Spectrum



Yankee Rowe Site

(5% Damping)

Attachment 2

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAY 2 0 1981

MEMORANDUM FOR: William Russell, Chief
Systematic Evaluation Program Branch
Division of Licensing

THRU: James P. Knight, Assistant Director
for Components and Structures Engineering
Division of Engineering

FROM: Robert E. Jackson, Chief
Geosciences Branch.
Division of Engineering

SUBJECT: FINAL REVIEW AND RECOMMENDATIONS FOR SITE SPECIFIC SPECTRA AT SEP SITES

On April 24, 1981, we received the most important outstanding items related to the Site Specific Spectra Study, Drafts of Volumes 4 and 5 of Seismic Hazard Analysis (Lawrence Livermore Laboratories). Please find enclosed our final review of this study with respect to the SEP. This review and our recommendations were prepared by Dr. Leon Reiter of the Geosciences Branch and are attached to this memorandum. A summary of these recommendations is:

1. We reaffirm the spectra recommended in the "Initial Review and Recommendations for Site Specific Spectra at SEP Sites" (Memorandum from R. Jackson to D. Crutchfield, June 23, 1980).

2. We find no need to reduce the spectra at rock sites. This possibility was raised in the June 23, 1980 Memorandum.

3. We have not taken into account possible anomalous site conditions at Palisades, LaCrosse or Yankee Rowe.

4. Application of this study and its review recommendations to other sites or other programs should be examined on a case by case basis.

We consider the recommended spectra and the evaluation of their conservatism as described in the section entitled "Conservatism of Recommended Spectra" in the attached review to be consistent with the general SEP approach. The assessment of these spectra with respect to safety and design adequacy should be considered within the context of structural and mechanical performance of plant structures, piping and equipment.

Based upon our ongoing review of site geology to satisfy SEP Topics II-4; Geology and Seismology, and II-4B: Proximity of Capable Structures to the Site, we do not anticipate that our final review of these topics will have any impact upon the recommended spectra.

Robert E. Jackson

Robert E. Jackson, Chief
Geosciences Branch
Division of Engineering

Enclosure:
As stated

cc: w/enclosure
R. Vollmer
D. Eisenhut
G. Lainas
W. Russell
T. Cheng
D. Crutchfield
F. Schauer
H. Levin
L. Wight, TERA Corp.
G. Lear
L. Heller
D. Bernreuter, LLNL
GSB Personnel

FINAL REVIEW AND RECOMMENDATIONS FOR SITE SPECIFIC SPECTRA AT SEP SITES

Purpose and Scope

This review presents final recommendations for Site Specific Spectra to be used in the reevaluation of SEP plants. It supplements "Initial Review and Recommendations for Site Specific Spectra at SEP Sites" (Memorandum from R. Jackson to D. Crutchfield, June 23, 1980, and referred to below as Initial Review) and is based upon those items reviewed for the Initial Review plus the following documents.

(1) Seismic Hazard Analysis: Volume 4, NUREG/CR-1582, Application of Methodology, Results and Sensitivity Studies (Draft) D. L. Bernreuter, LLNL April 1981 NUREG/CR-1582. (Referred to below as Volume 4).

(2) Seismic Hazard Analysis: Volume 5, NUREG/CR-1582, Peer Review, Eastern Ground Motion Panel and Formal Feedback (Draft) D. L. Bernreuter LLNL, April 1981 (Referred to below as Volume 5).

(3) Final Report Seismic Hazard Analysis: Results, TERA Corporation, February 1981.

(4) Introduction to Ground Motion Panel, TERA Corporation, February 1980.

(5) Second Round Questionnaire, TERA Corporation, September 1980.

(6) Seismic Hazard Analysis: Solicitation of Expert Opinion Second Round Questionnaire, TERA Corp., January 1981.

All of the above documents and many of those listed in the initial review will appear in their final form as text or appendices in volumes 4 and 5 of NUREG/CR-1582 Seismic Hazard Analysis. Two segments of this study, Volume 2, "A Methodology for the Eastern U.S.," and "Volume 3, "Solicitation of Expert Opinion," have already been published. Volume 1 of this series, which represents an executive summary of the study, has not yet been submitted. Items originally listed in the Initial Review which have not been received are:

(1) Review of the Draft Seismic Hazard Analysis by the USGS,

(2) Additional Review and Comments by Drs. Newmark and Hall.

Licensee submittals for individual SEP sites are being handled by the SEP Branch separately on a case by case basis.

Recommendations

In the Initial Review the following recommendation was made.

"It is recommended that the following spectra presented in the Sensitivity Results (May 1980) be used as site specific free field spectra.

Eastern U.S. (Yankee Rowe, Connecticut Yankee, Millstone, Ginna, Oyster Creek) - "1000 year" spectra assuming no background and Ossippee Attenuation.

Central U.S. (Dresden, Palisades, LaCrosse, Big Rock Point) - "1000 yr" spectra assuming no background and Gupta-Nuttli Attenuation.

These spectra account for gross site conditions (soil or rock) and do not take into account any specific conditions which may result in amplification (LaCrosse, Yankee Rowe, Palisades).

It is also recommended that a minimum be established for which no spectra be allowed to go below. It is suggested that this minimum be the median (50th percentile) representation of real spectra for a magnitude 5.3 earthquake. This minimum exceeds the "1000" yr spectra for Big Rock Point, LaCrosse and Palisades at frequencies greater than 2 to 3 Hz."

Based upon review of the documents and information received since preparation of the Initial Review, we conclude that the recommended spectra as described above in the Initial Review are appropriate for use in the Systematic Evaluation Program. The rationale for this conclusion is discussed below.

Digitized response spectral values (5% damping) for each site and a scaling relationship which can be used to derive spectra at other damping values are attached to this review (Enclosure 1).

Basis for Previous Recommendation

As described in the Initial Review the above recommended spectra depend upon several important assumptions by the staff. They are:

(1) The appropriate ground motion model to be used in the Central-U.S. was that based upon a modification of the Gupta and Nuttli (1976) relation.

(2) The appropriate ground motion model to be used in the northeastern U.S. was that calculated from the 1940 Ossippee earthquake. The particular version of the Ossippee model to be used is that which was originally presented since it is more analagous to that used by Gupta and Nuttli (1976) for the central U.S. and falls closest to theoretical models of ground motion.

3) The appropriate zonation assumptions should be intermediate between those labeled "Background" and "No Background".

4) The appropriate dispersion assumed for ground motion estimation should be $\sigma = 0.7$ (natural logarithms) truncated at $\pm 3\sigma$.

5) The recommended spectra can be associated with return periods of the order of 1,000 to 10,000 years.

The additional review herein concentrates upon the appropriateness of the preceeding assumptions in light of the new material received.

Feedback and Second Round Questionnaire

The most important item received since the previous review centers about convening the experts for a round table discussion and the submittal by them of answers to a second-round questionnaire. At the meeting of the experts the results of the first questionnaire, calculated results, and sensitivity parameters were presented and discussed. This meeting was followed by submittal of a second round questionnaire which gave each expert the opportunity to modify his input to the study regarding the seismicity models used in the LLNL/TERA analysis. In addition each expert was asked to explicitly address those issues which were not adequately discussed previously and were shown to have an important effect upon the calculated spectra. It is important to point out that in the interim (between responding to the first and second questionnaires) there occurred an $m_{blg} = 5.2$ earthquake in Kentucky.

This was the largest event to occur in the U.S. east of the Rocky Mts. since the southern Illinois earthquake of 1968 and it provided an opportunity to test the effect of new information upon the experts' input and the calculated spectra.

Chance in Seismicity Models

Most of the experts suggested some changes in their seismicity models. While many of these changes were minor, some had possible major impact upon the calculated results. One expert provided a significantly different seismic zonation than he previously had provided, several changed their upper magnitude cut-off and two experts suggested modified b values. Qualitative assessments of the impact of these changes on calculated results were originally made (Volume 5) indicating net changes in resulting ground motion for individual experts ranging from a 5% decrease to a 30% increase in the central U.S. and from a 15% decrease to a 15% increase in the eastern U.S. It was also felt that the effects of these individual changes in the input would lead to changes in the synthesis that would certainly be less than 15% in the central U.S. and less than 10% in the eastern U.S. LLNL recalculated results (Volume 5) for four of the experts. (The generic parameters were the same as those recommended in the Initial Review). The experts selected were those for whom most of the larger changes were indicated. Many of the changes were not as large as originally anticipated particularly for the expert who had large changes in zonation. As a result of the recalculations it was estimated (LLNL) that the change in any synthesis would be less than 10%. Based upon our

examination of the individual results we believe that this can be even further restricted to less than about 5%. This net change in synthesis ground motion would be least (a very slight increase or decrease) in the eastern U.S. and reach an increase of perhaps several percent in the central U.S. It is important to note that probabilistic estimates remain quite stable in particular those based upon a syntheses of opinion even though some of the input parameters may vary significantly. This is due primarily to the balancing effects which result from the changes in different input parameters for the same expert and the balancing effects which result from changes in input parameters from different experts.

Feedback on Generic Assumptions

The experts were asked to provide their input on generic assumptions previously assumed in the study which were applied to all the inputs uniformly. With respect to the assumption of "background" vs. "no background" most of the experts (6) supported the original assumption of background (and zone supposition) while the others were either unsure, rejected this concept or offered no opinion on the subject.

With regard to the choice of the ground motion model the opinion was diversified. Different models including some which were not previously considered were recommended. There seemed to be a preference for intensity attenuation based upon several earthquakes and the use of different models for

the central and northeastern regions. Some recommended the use of theoretical models. With respect to the uncertainty assumed in the ground motion model the experts recommended the use of standard deviations (σ) which ranged from $\sigma = 0.5$ to $\sigma = 0.9$ with some preference for the 0.6 to 0.7 range.

Effect of Second Round Questionnaire Upon Conclusions of the Initial Review

As indicated above the preferred model for calculating risk suggested in the Initial Review assumed Gupta-Nuttli intensity attenuation in the central U.S., Ossippee Intensity attenuation in the eastern U.S., a dispersion of $\sigma = 0.7 \pm 3\sigma$ and an intermediate position between "background" and "no background". Zone superposition was assumed to be coincident with the assumption of background. Since calculations were not carried specifically for this model of dispersion and background, existing models were examined and we concluded that the calculations based upon $\sigma = 0.9 \pm 2\sigma$ and no background would approximate the desired results. The higher level of ground motion (+7 to +10%) in the calculated result which was caused by assuming greater dispersion was balanced by the lower level of ground motion (-7 to -10%) in the calculated result which was caused by assuming no background.

With respect to generic assumptions in the Initial Review, input from the Second Round Questionnaire can be summarized as follows.

1) There is no preferred guidance from the experts as to which intensity attenuation relation should be used.

2) The use of a standard deviation of $\sigma = 0.6$ to $0.7 \pm 3\sigma$ (Second Round expert preference) as compared to the use of $\sigma = 0.9 \pm 2\sigma$ would result in a decrease of 10 to 15% in estimated ground motion at the level recommended in the Initial Review (Volume 5).

3) The use of a generic seismicity model which favored the use of background (Second Round expert preference) with respect to a model which assumed no background would result in an increase of about 10% or more in estimated ground motion at the level recommended in the Initial Review.

4) The use of revised inputs for seismicity and zonation would result in an estimated change of 5% or less in estimated ground motion at the level recommended for the various sites in the Initial Review.

Based upon the above discussion, we estimate that inclusion of input from the Second Round Questionnaire would lead to calculated site specific spectra which would be roughly similar to those recommended in the Initial Review differing at most by several (less than 10) percentage points. This is not to say however that an individual expert would not or could not provide input that would lead to calculated spectra that were different. Slight variations in the choice of attenuation model and ground motion dispersion alone could have a major impact upon the results. What these results do indicate however is the relative stability of integrated estimates synthesized from different individual input assumptions.

Comparison with Other Studies

The Final Report Seismic Hazard Analysis: Results, (TERA Corporation, 1981) includes a comparsion with several other seismic hazard studies. In general it was found that when using input taken from other studies with the TERA computer code, the same results were obtained and that the difference between these results and those obtained using input from the expert panel could be explained by differences in assumptions. One of the studies compared was a probabilistic assessment of ground motion carried out to assess the likelihood of liquefaction at LaCrosse (Dames and Moore, 1980). Taking into account the variations in input, the Dames and Moore (1980) study and that performed by TERA-LLNL are in close agreement.

An interesting comparison was also made utilizing a "pseudo-historical" analysis at Dresden and Yankee Rowe. In this analysis, no zonation is assumed and the probability of exceeding a given level of ground motion is determined entirely from the historical record. Lacking instrumental records the ground motion itself is estimated from a given attenuation model. These estimates are sensitive to the inclusion of rare events such as the 1811, 1812 New Madrid Series and have not been corrected for homogeneity or upper magnitude cutoff. They do however yield results that are generally within the range of ground motion estimates calculated from the inputs of the individual experts for these sites.

Adequacy of Spectra for Rock Sites

In the cover letter to the Initial Review it was indicated that a reduction in spectra at intermediate and low frequencies may be called for at rock sites (Dresden, Ginna, Haddam Neck and Millstone). The change (Table 5-2, Final Report Seismic Hazard Analysis: Results, TERA Corporation, 1981) was recommended by TERA Corporation based upon its restructuring (weighting) of the strong motion data set used in ground motion estimation primarily to avoid overemphasis upon the 1971 San Fernando Earthquake. While this restructuring may be valid for estimating ground motion as a function of magnitude and intensity or distance, LLNL has pointed out (Volume 4) that it also results in a significant reduction in the number of rock records since many such records resulted from the San Fernando Earthquake. We agree therefore with LLNL's assessment that the original nonweighted model is more appropriate for determining differences in ground motion between rock and soil sites and no reduction is called for.

Conservatism of Recommended Spectra

Our estimate in the Initial Review was that although the recommended spectra were labelled "1000 year" spectra the actual return periods associated with these spectra were longer. TERA Corporation had estimated these actual return periods to be closer to 5,000 or 10,000 years. While we were not sure what the precise estimates were we concluded that they were consistent with the previous implicit acceptance of design spectra that were assumed to have return periods of the order of 1,000 or 10,000 years. As a result of this final review we find no new information that changes our previous estimate.

Since other levels of ground motion-spectra could fit into this range of probabilities it is worthwhile reexamining the criteria by which the recommended spectra were found to be appropriate.

1. These spectra, whatever their true return periods actually are, represent approximately equivalent levels of seismic hazard at the different SEP sites currently being considered and represent a more consistent estimate to be used in seismic analysis than standard "deterministic" procedures. These "deterministic" procedures generally rely upon tectonic provinces and controlling earthquakes regardless of the size of the tectonic province or the frequency of earthquake occurrence. As a result, these procedures can lead to the acceptance of different levels of seismic hazard at different locations.. The recommended spectra generally indicate a relatively greater earthquake hazard associated with sites in the northeast when compared to sites in the upper midwest.

2. When compared to the deterministic procedure recommended for use in the SEP in NUREG/CR-0098 the recommended spectra as a group bracket the 50th and 84th percentile deterministic spectra as calculated in the Initial Review.

3. When compared to non-probabilistic site specific spectra derived from real records, an approach currently being pursued with many OL reviews, the recommended spectra vary from the 84th percentile to the 50th percentile representation of a magnitude 5.3 earthquake. The 50th percentile of the

spectra from real records was specified in the Initial Review as the minimum which recommended spectra would not be allowed to fail. The 84th percentile is that level which has been used in OL reviews.

4. The recommended spectra form a band centered about the Regulatory Guide spectrum anchored at 0.1g. New plants licensed in these areas would most likely utilize peak accelerations of 0.12 to 0.20 g to anchor the Regulatory Guide Spectrum.

Based upon the above discussion we consider this approximate overlap of the higher of the recommended spectra with the mid to lower range of those spectra estimated applying current deterministic criteria to indicate that the recommended spectra can be generally associated with the higher end of the range of implicitly assumed seismic hazard that has been found acceptable using current criteria.

Lacking more defined levels of acceptable seismic hazard and a prescribed method for calculating this hazard, the use of individual and often non-quantifiable judgement cannot be avoided in assessing the results of this study so as to integrate it with other techniques into a decision-making framework.

Based upon the above comparison it is our position that the recommended spectra represent the appropriate levels of free field ground motion to be used in the SEP for the purpose of evaluating the seismic design adequacy of the selected plants.

Application of this study and its review recommendation to other sites or other programs should be examined on a case by case basis.

Anomalous Site Conditions

As was indicated in the Initial Review these spectra only account for gross site conditions (soil or rock). No attempt was made to consider soil amplification beyond that already inherent in the soil records used in the study. LaCrosse, Palisades, and Yankee Rowe have been identified as having site conditions which may be anomalous with respect to those site conditions associated with the soil records used in this study.

Enclosure 1

SEP 17 1980

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HLEVIN

MEMORANDUM FOR: Dennis M. Crutchfield, Chief
Systematic Evaluation Program Branch

FROM: Howard Levin, Technical Assistant
Division of Engineering

SUBJECT: DIGITIZED PSEUDO SPECTRAL ACCELERATION DATA FOR SEP PLANTS

Attached are digitized pseudo spectral acceleration values (5% damping) for the preliminary site specific ground response spectra transmitted to you in a letter from R. Jackson, dated June 23, 1980. Noted is a scaling relationship which can be used to convert from the 5% damped spectra to spectra in the range of 2% to 20%.

Howard Levin, Technical Assistant
Division of Engineering

cc: D. Eisenhut
R. Vollmer
J. Knight
R. Jackson
L. Reiter
J. Greeves
T. Cheng

OFFICE	NRR/DE					
SURNAME	HLevin:mg					
DATE	9/17/80					

SYSTEMATIC EVALUATION PROGRAM
SITE SPECIFIC SPECTRA
PSEUDO SPECTRAL ACCELERATIONS (cm/sec^2)

Yankee Rowe	Oyster Creek	Ginna	Haddam Neck	Millstone	Big Rock Pt.	LaCrosse	Palisades	Dresc
203.00	172.61	178.85	215.91	196.23	122.29	122.29	122.29	134.
213.69	178.17	192.52	228.92	210.91	130.19	130.19	130.19	142.
247.74	206.77	230.16	279.47	253.44	152.05	152.05	152.05	164.
275.68	229.98	258.38	316.00	287.00	179.69	179.69	179.69	181.
434.80	363.77	388.92	475.17	433.65	213.50	213.50	214.77	270.
455.49	376.59	375.82	456.79	415.45	201.96	201.96	224.41	257.
408.76	339.90	328.79	395.71	360.53	171.68	195.71	218.32	249.
224.32	180.98	165.10	183.25	165.68	122.90	151.98	174.57	185.
195.20	161.33	168.65	202.48	184.16	102.50	102.50	102.50	124.
22.48	18.41	16.92	19.66	17.82	11.39	13.50	15.18	16.

CONVERSION TO OTHER DAMPING VALUES (RANGE 2% - 20%)

$$PSA_{x\%} = PSA_{5\%} \times 10^{C_T \times (\text{new damping}(x) - .05)}$$

Mod	C_T
4	**
5	**
55	-0.290
3	-0.600
0	-0.904
3	-1.270
0	-1.700
0	-1.990
0	-1.950
5	-1.810
	-1.960

Units =cm/sec
Statistically Insignificant Coefficient, Use 5% PSA Value

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555
July 9, 1981

Tom
Gate
file

Docket No. 50-244
LS05-81- 07-014

RECEIVED
JUL 10 1981
U.S. NUCLEAR REGULATORY COMMISSION

Mr. John E. Maier, Vice President
Rochester Gas & Electric Corporation
89 East Avenue
Rochester, New York 14649

Dear Mr. Maier:

SUBJECT: SEP REVIEW TOPICS II-4, GEOLOGY AND SEISMOLOGY AND II-4.B, PROXIMITY OF CAPABLE TECTONIC STRUCTURES IN PLANT VICINITY

Enclosed is a copy of our evaluation for Systematic Evaluation Program Topics II-4, "Geology and Seismology," and II-4.B, "Proximity of Capable Tectonic Structures in Plant Vicinity." These assessments compare your site condition, as described in the docket and references with the criteria currently used by the staff for licensing new facilities. Please inform us if your site condition differs from the licensing basis assumed in our assessments.

Our review of these topics is complete and this evaluation will be a basic input to the integrated safety assessment for your facility unless you identify changes needed to reflect the existing site condition at your facility. These topic assessments may be revised in the future if NRC criteria relating to these topics are modified before the integrated assessment is completed.

Sincerely,

Walter A. Paulson

for Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

SE04
S1/1

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Herbert Grossman, Esq., Chairman
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SEP SAFETY TOPIC EVALUATION

R. E. GINNA NUCLEAR POWER PLANT

TOPIC II-4, GEOLOGY AND SEISMOLOGY

Introduction

During the time frame when SEP plants were designed, the licensees, because compliance with Regulatory Guide 1.70 was not required, usually provided only very minimal information in geologic and seismologic areas. Therefore, in order to assess the adequacy of the design of these older plants with respect to local geologic and seismologic phenomena, a re-review was necessary. The scope of this topic review included surface faulting, potential landslides, ground collapse, possibility of liquefaction, etc.

Review Criteria

1. Standard Review Plan Sections 2.5.1, 2.5.2, 2.5.3, 2.5.4 and 2.5.5
2. Appendix A to 10 CFR Part 100

Related Safety Topics and Interfaces

The related safety topics are II-4.A, II-4.B, and II-4.C. The conclusion from each of these sub-topics form a part of the overall conclusion for this topic, i.e., site specific ground response spectrum for this site.

Evaluation

The geology and seismology of the Ginna site were first reviewed in 1965 and 1966 by the Atomic Energy Commission (AEC) and its advisors, the U. S. Geological Survey (USGS) and the Environmental Science Services Administration (ESSA) of the Coast and Geodetic Survey. In its report the USGS concluded that a relationship between seismicity and mapped faults had not been demon-

strated within the area. The ESSA concluded after its review of the regional seismicity that the plant should be designed for a moderately strong earthquake having an acceleration of approximately 0.20g without loss of function of components important to safety.

Recently, as a part of the SEP, a re-review of the seismological hazard at the Ginna site was conducted through the Site Specific Spectra Program for the Eastern United States SEP facilities. The current recommendation for the seismic input ground motion was transmitted to the SEP Owners in a letter from D. M. Crutchfield, dated June 17, 1981. In Attachment 2 to the letter, a memo from the Geosciences Branch, Division of Engineering, entitled, "Final Review and Recommendations for Site Specific Spectra at SEP Sites," the following conclusion was drawn:

> "Based upon our ongoing review of site geology to satisfy SEP Topics II-4: Geology and Seismology, and II-4.B; Proximity of Capable Structures to the Site, we do not anticipate that our final review of these topics will have any impact upon the recommended spectra."

The geology of the site was re-assessed by the AEC staff when Rochester Gas & Electric Corporation (RG&E) applied for a full term license in August 1972. At that time RG&E reported the discovery of faults adjacent to Ginna during investigations for an alternate site for its Sterling Power Project. We reviewed the available data concerning these faults and concluded that they were not capable within the meaning of Appendix A, 10 CFR Part 100.

Other new information that we became aware of since the CP review was the existence of relatively high residual stresses in bedrock in the Lake Ontario region (Fitzpatrick PSAR and FSAR, Sbar and Sykes, 1973, and Dames and Moore,

1978, Nine Mile Point Geologic Investigations). We have reviewed the available data and conclude that if such stresses were present at the Ginna site they were most likely relieved during excavation and construction and do not represent a problem to the plant. In response to staff questions RG&E confirmed that during the life of the plant there have been no occurrences such as cracked walls or foundations that can be attributed to high stresses in bedrock.

During the SEP geological review of the Ginna site the staff reviewed the following materials: the Ginna PSAR, SER, Dames and Moore Geological and Geophysical Investigations Ginna Site, Dames and Moore Geologic Investigations Nine Mile Point Unit 2, aerial photographs, topograhic maps, and selected documents from the open literature (a list of references is at the end of this chapter).

The following paragraphs present a brief description of the regional and site geology.

The site is located on the southern shore of Lake Ontario in the eastern portion of the Erie-Ontario Lowlands Physiographic Province (Fenneman, 1938). The regional topography is of low relief and rises gradually from an elevation of +250 msl at the lake to +500 at the Portage Escarpment which is the northern boundary of the Appalachian Plateau Province to the south. A beach ridge 10 to 25 feet high parallels the shoreline of Lake Ontario 4 miles to the south. North of the ridge is the lake plain of former glacial Lake Iroquois. The site lies on this plain.

The southern margin of Lake Ontario is characterized by many promontories which seem to reflect prominent joint directions in bedrock. The site is located

near one such promontory called Smokey Point. Major joint directions are N 75° to 85°E and N10°E to 30°W. Erosional bluffs along the lake range from 15 to 30 feet high. Smokey Point is located at the eastern end of a 5 mile long ridge, the crest of which is about +310'. Relief in the site area is low with elevations ranging from +360 to +300. The site is underlain by 20 to 60 feet of glacial deposits, and approximately 2700 feet of Paleozoic (570 million years before present mybp to 225 mybp) sedimentary rocks over crystalline basement. The uppermost Paleozoic unit is sandstone of upper Ordovician (455 to 430 mybp) Queenston Formation.

The glacial deposits include at least two till horizons. The lower unit overlies bedrock and varies in thickness from 6 to 25 feet. This unit consists of grayish red, calcarous, silty clay. The unit is poorly sorted and contains numerous striated and faceted pebbles, cobbles and boulders. The upper till unit is at or near the ground surface and ranges from 7 to 30 feet in thickness. This unit is composed of relatively uniform olive gray to yellow brown silty, sandy clay, with large boulders several feet in diameter. Between the two till horizons is a zone of lakebed deposits consisting of gray, very plastic clay.

RG&E has determined by regional correlation that the lower till unit is associated with the Woodfordian glacial advance, a substage of the Wisconsinan Stage, which took place about 22,000 years ago. The lakebed deposit is believed to have been deposited in the bed of Lake Iroquois. The upper till is related to a minor glacial readvancement that occurred about 12,000 years ago. The staff has examined the evidence and agrees with the licensee's interpretation.

Conclusion

Based on the information provided in the references, the acceptable conclusions of Topics II-4.A, II-4.B, and II-4.C and the evaluation stated above, we conclude that the information used for developing site specific spectra is adequate and have re-affirmed that local geologic and seismologic phenomena will not affect the plant.

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SEP SAFETY TOPIC EVALUATION

R. E. GINNA NUCLEAR POWER PLANT

TOPIC II-4.B, Proximity of Capable Tectonic Structures in Plant Vicinity

Introduction

In order to assure that the local geological features and the expected ground shaking characteristics will not endanger the safety of plant facilities, an evaluation should be made on the characteristics of local geological features. The scope of this topic evaluation is to review the existing information provided by licensee and to identify new features such as capable faults, etc.

Review Criteria

1. Standard Review Plan Section 2.5.2
2. Appendix A to 10 CFR Part 100

Related Safety Topics and Interfaces

The related safety topics are II-4, II-4.A and II-4.C. The results of this review topic may affect the conclusion drawn for these related topics, i.e., site specific ground response spectra developed for the SEP plants.

Evaluation

Within the Ontario Lowlands the nearest regional faulting is the Clarendon-Linden structure near Batavia, New York. The structure trends north-south and is about 35 miles west of Ginna. The fault is described (Fakundiny et al, 1978) as a complex faulted zone with major north-south set of subparallel normal and reverse faults that have a cumulative displacement of approximately 100 meters with east side up. Data suggests that the zone is continuous to the north across Lake Ontario for a total length of as much as 180 km.

Fakundiny et al (1978) found no unequivocal evidence of post glacial faulting among 36 faults, 6716 joints and 87 pop-ups studied around the Clarendon-Linden fault system. However, numerous earthquakes, including the 1929 Modified Mercalli Intensity VIII earthquake, have occurred within the fault system near Attica. A number of seismologists have concluded that these events are probably related to solution mining of salt.

The presence faults has been documented at the Nine Mile Point and Fitzpatrick nuclear sites approximately 50 miles east of Ginna. The structures are three west-northwest striking high angle faults, and several north-south striking thrust faults and folds. Displacements range from inches to several feet. Several of the faults mapped at Nine Mile Point, Unit 2 have been shown to have undergone some movement during the last 10,000 years. Although the NRC staff has not completed its review of these faults we have tentatively concluded that the most recent displacements are most likely associated with the complex phenomena caused by glacial loading and unloading. However, no such post Pleistocene faults have been identified at Ginna.

A structural complex was also discovered at the proposed New Haven site located a few miles east of Nine Mile Point. These structures consist of a large northeast striking anticline with several associated faults. The folds and faults were demonstrated by the applicant to be non capable within the intent of Appendix A (NYSE&G 1 and 2 PSAR).

Several minor normal faults with 2 to 15 feet of displacements have been identified between the site and northward projection of the Clarendon-Linden fault. There is no evidence that indicates post Pleistocene (less than 10 mybp) movement along these faults.

During an investigation conducted by Rochester Gas and Electric Company (RGE) in 1973 adjacent to the Ginna Nuclear site for an alternate site for the Sterling Power Project, evidence of faults was found in core borings. An extensive investigation program was carried out. The investigations included a large trench excavated across the fault zone, additional borings, petrofabric and minerological analyses, testing of samples from the fault zones, geophysical explorations, and surface geological mapping.

The studies revealed that the fault zone was comprised of three down-to-the-northeast faults that trended N65^{o}W. The maximum offset is about 26 feet which decreases to about 6 feet to the southeast near the plant. The fault zone passes about 30 feet southwest of the Reactor complex. Three geological reconaissanceswere made by a staff geologist to the site to review progress of the investigations and examine features exposed in trenches across the fault zone.

A large trench across the fault revealed extensive deformation of glacially deposited horizons but there was no deformation that was directly attributable to tectonc movement along the faults.

The strongest evidence that these deformations are not related to tectonic displacement on the bedrock faults is the presence of a horizontal unit at the base of the lower till which lies undisturbed across the southernmost fault, and stacking planes (imbricate thrust sheets caused by the southward advancement of the glacier) that cut across the faults without displacements.

RG&E also attempted to determine the age of fault gouge by radiometric techniques, but the results were unreliable. However, other lines of evidence indicate a much older age of last movement than Pleistocene. This evidence includes:

(1) the observation that the contemporary stress field is different from that in which the fault originated. According to Sbar and Sykes, 1973 the contemporary stress picture in Western New York is one of nearly horizontal compression oriented in an eastwest direction. Evidence for this is local squeeze and pop-up features and in-situ stress measurements in the region. The existing stress field is not consistent either in orientation or type of stress field in which the faults were formed, and the stress regime in which the faults were formed was essentially northeast-southwest and tensional.

(2) The presence of unsheared hydrothermal crystals within the fault zone demonstrate that faulting predates the hydrothermal event which deposited the crystals and this event probably occurred no later than the Cretaceous (65 million years ago). Analyses carried out by consultants to RG&E show that the mineralization of fluid inclusions in calcite crystals along with sulfide mineralization, particularly pyrrhotite and molybdenite, more than likely reflect hydrothermal mineralization at temperatures of at least 225° to $300^{o}C$. The last known tectonic environment within which such conditions could have developed in the area was about 65 million years ago.

(3) No recorded historic earthquake has occurred which could be associated with the faults.

We therefore conclude that the faults at least predate the latest major glacial advance which occurred about 22,000 years ago. The weight of all the available information indicates that the faults are more than 65 million years old.

Construction photographs of the Ginna excavation were examined by the staff. There were ample fair quality photos to cover most of the walls of the major excavation. Bedrock bedding could be clearly seen in many of the photographs, and, although there are numerous joints, there is no indication of displacement. We therefore, can conclude that there is no faulting directly beneath the major Category I structures of the plant.

Conclusion

Based on the information by the licensee and the analysis described above, we conclude that there are no capable faults in the vicinity of Ginna site, and that conclusions made during licensing reviews are still valid.

REFERENCES

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Dames and Moore, 1965, Site Evaluation Study, Proposed Brookwood Nuclear Power Plant, Ontario, New York, Rochester Gas and Electric Corp.

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Power Authority State of New York, 1972, James A. Fitzpatrick Nuclear Power Plant Final Safety Analysis Report.

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Stone and Webster, 1978, Report of Fault Investigations at Fitzpatrick Nuclear Power Plant, for Power Authority of the State of New York.

U. S. Geological Survey, 1966, Geology and Hydrology of the Proposed Brookwood Nuclear Station No. 1 site, Wayne County, New York, 28 Feb., 1966 letter to H. L. Price, USAEC from the Acting Director USGS.

TOPIC II-4.C

SEE TOPIC II-4.A

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Docket No. 50-244
LS05-82-

Mr. John E. Maier, Vice President
Electric and Steam Production
Rochester Gas & Electric Corporation
89 East Avenue
Rochester, New York 14649

Dear Mr. Maier:

SUBJECT: GINNA NUCLEAR POWER PLANT - FINAL EVALUATION OF SEP HYDROLOGY TOPICS II-3.A, II-3.B, II-3.C, AND II-4.D

We have completed our review for SEP Topics II-3.A, Hydrolic Descriptions, II-3.B, Flooding Potential and Protection Requirements, II-3.B.1, Capability of Operating Plants to Cope With Design Basis Flooding Conditions, II-3.C, Safety-Related Water Supply and II-4.D, Stability of Slopes. Enclosed are the evaluations (Enclosure 1) supporting the conclusions drawn by the staff in our letter dated April 26, 1982, "Ginna Nuclear Power Plant - Final Evaluation of SEP Hydrology Topics II-3.A, II-3.B and II-3.C." Also, enclosed is our final safety evaluation report for SEP Topic II-4.D (Enclosure 2). These evaluations will be a basic input to the integrated safety assessment for your facility unless you identify changes needed to reflect the as-built conditions at your facility.

Sincerely,

Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

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Systematic Evaluation Program Topic Assessment

Topic: II-4.D - Stability of Slopes
Plant Name: R. E. Ginna Nuclear Power Plant
Docket Number: 50-244
Prepared by: J. T. Chen, Geotechnical Engineer, HGEB

I. INTRODUCTION

This topic pertains to the Geotechnical Engineering Review of the stability of all slopes, whose failure could adversely affect the safety of the plant. The scope of the review embraces the following subjects which are evaluated using data developed by the licensee and information available from all sources: (1) slope characteristics; (2) design criteria and analyses; (3) results of field and laboratory tests; (4) excavation, backfill, and earthwork in slopes; (5) liquefaction potential affecting slopes; and (6) proposed instrumentation and performance monitoring.

II. REVIEW CRITERIA

The applicable rules and basic acceptance criteria pertinent to the review of this topic are:

1. 10 CFR Part 50, Appendix A: GDC 1, 2 & 4
2. 10 CFR Part 100, Appendix A
3. Regulatory Guides
   (a) Regulatory Guide 1.132, "Site Investigations for Foundations of Nuclear Power Plants."
   (b) Regulatory Guide 1.138, "Laboratory Investigations of Soils for Engineering Analysis and Design of Nuclear Power Plants."

III. RELATED SAFETY TOPICS AND INTERFACES

1. SEP Topic II-4.F "Settlement of Structures and Buried Equipment"
2. SEP Topic II-4, "Geology and Seismology"
3. SEP Topic III-1, "Classification of Structures, Components and Systems"
4. SEP Topic III-6 "Seismic Design Considerations"

IV. REVIEW GUIDELINES

In general, the review process was conducted in accordance with the procedures described in Standard Review Plan Section 2.5.5. The geotechnical engineering aspects of the design and as-constructed condition of slopes were reviewed and compared to current procedures and criteria and the safety significance of any differences was evaluated.

Pertinent reference documents not cited in SRP Section 2.5.5 are included in part V "Topic Evaluation".

V. TOPIC EVALUATION

Two onsite slopes, whose failures may be of safety concer, were identified by the licensee (Ref. 1). The first slope is located about 200 feet northwest of the turbine building while the second slope is located east of the screen house. Both slopes were excavated from the original ground elevation of about 270 ft down to elevation 255 ft in silty clay soil and were graded at approximately 7.5 horizontal to 1 vertical.

The subsurface exploration program of 1964 (Ref. 2) revealed that the bedrock of red siltstone was at depths ranging from 30 to 40 feet below the original ground surface. The overburden soils consisted of reddish-brown clayey silt, silty clay, and sand and gravel layers. The thicknesses and the engineering properties of those soils varied considerably throughout the site.

One boring (#1) was drilled at the first slope, and two borings were (#3 and #119) drilled at the second slope. The laboratory tests performed in 1964 were very limited and the shear strengths of the soft clayey soil varied in a wide range. The licensee did not make any attempt during the current SEP evaluation to determine either the subsurface conditions or the appropriate soil properties at those slopes. Therefore, in order for the staff to assess the stability of those slopes, assumptions have been made about the subsurface conditions and the soil parameters. The sectional profile of the first slope was assumed to be represented by boring #1, the second slope by boring #3. Conservative soil parameters obtained from the 1964 investigation were used in the slope stability analyses.

Stability analyses, both static and pseudostatic with earthquake load, were performed by the staff using a commercially available computer program -- MCAUTO's "Slope" program. Material properties which controlled the stability analyses are tabulated below:

Soil Layer No.	Soil Type	Thickness Below Top of Slope ft	Total Unit Weight, pcf	Cohesion c (psf)	Angle of Internal Friction Ø (deg)
1.	Reddish-brown clayey silt	12	107	130	20
2.	Brownish-clay silty clay	24	108	120-250	0
3.	Red fine sand & gravel	8	130	0	38
4.	Bedrock (siltstone)	N/A	N/A	N/A	N/A

NOTE: Groundwater level was assumed at elevation 245 ft above sea level (10 feet below the toe of the slopes).

The earthquake load used in the analyses is equal to the safe shutdown earthquake, 0.2g, for the Ginna Station.

The results of the slope analyses show that the factors of safety against slope failure under both static and earthquake loading conditions are less than unity, indicating that these slopes are not stable and that failure would take place along an arc of radius about 175 feet. These analytical results disagree with the licensee's contention which stated that the slopes are unconditionally stable (Ref. 3). The staff believes that the shear strength of the in situ silty clay soil should have gained strength because of consolidation of the clayey soil, but there is no new data about the in situ soil conditions and strengths, so reasonably conservative soil data has been used by the staff in the analyses.

Since the slopes were not determined to be stable, the impact of their failures was further evaluated by the staff. The most critical failure arc, as calculated, would intercept the slope at elevation 276 ft, adjacent to the crest and at elevation 257 ft, adjacent to the toe. The lateral spread of the slope failure adjacent to the toe is estimated by the staff to be somewhere around 8 feet, based on post-failure equilibrium.

At the first slope, located northwest of the turbine building, there is no structure nor equipment located within or adjacent to the slope except a roadway. Therefore, the failure of that slope would not pose any safety concern, but might close the road.

At the second slope, located east of the screen house, there is a 28-foot diameter storage tank located adjacent to the slope and it would be affected by a slope failure. The licensee stated to the staff in a telecon on May 11, 1982 that the tank is not a safety class equipment (Ref. 4). Therefore, failure of the second slope would not pose any safety concern, either.

VI. CONCLUSIONS

Based on the review of the licensee's submittal and several telecons with the licensee, the staff has concluded that the stability of the two on-site slopes could not be confirmed analytically. However, the actual failure of these slopes would affect no safety facilities and pose no safety concern at the Ginna Plant.

REFERENCES

1. Letter from J. Maier, RG&E to D. Crutchfield, NRC dated June 30, 1981.

2. Letter from J. Maier, RG&E to D. Crutchfield, NRC dated January 15, 1982.

3. Letter from J. Maier, RG&E to D. Crutchfield, NRC dated April 19, 1982, received April 28, 1982.

4. Telephone conversation with G. Wrobel of RG&E on May 11, 1982.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

November 16, 1979

Docket No. 50-244

Mr. Leon D. White, Jr.
Vice President
Electric and Steam Production
Rochester Gas and Electric Corporation
89 East Avenue
Rochester, New York 14649

Dear Mr. White:

By letter dated April 16, 1979, we sent you the list of topics which would not be reviewed for your plant in the Systematic Evaluation Program (SEP). These topics were proposed for deletion from the SEP because they were not applicable to your plant or they were being reviewed as part of an ongoing generic issue outside the SEP. Most of the licensees of plants in the SEP provided comments on these lists. We have reviewed those comments and have conducted further internal review of our original listings. As a result, we have enclosed new listings which supersede the lists transmitted on April 16, 1979.

Enclosure 1 is the list of topics which are being reviewed as part of ongoing generic issues outside of the SEP. The SEP will only monitor the status of these topics. If the topic is completed and implemented during the course of the SEP, a topic assessment will be issued which identifies the licensing action and safety evaluation report (SER) supporting the final disposition of that topic. If an implementation position is developed but no licensing action has been taken, the issue will be considered for implementation on SEP plants on a case-by-case basis. If no implementation position has been developed by the end of the SEP, the topic assessment will merely report the status of the generic effort.

Enclosure 2 is the list of topics that have been deleted from the review of your plant because they are not applicable to your facility or site. No topic assessments will be written for these topics.

Sincerely,

Thomas V. Wambach
for Dennis L. Ziemann, Chief
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Division of Operating Reactors

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ENCLOSURE 1

R. E. GINNA

SEP TOPICS NOT REQUIRING REVIEW DUE TO ONGOING GENERIC LICENSING ACTIVITIES

TOPIC III-8-A:	LOOSE PARTS MONITORING AND CORE BARREL VIBRATION MONITORING
COMMENTS:	Implementation status pending RRRC decision.
TOPIC III-8-D:	CORE SUPPORTS AND FUEL INTEGRITY
COMMENTS:	This topic is being reviewed generically by DOR under TAP A-2 for PWR's. Future A-2 under development for BWR's.
TOPIC III-9:	SUPPORT INTEGRITY
COMMENTS:	Generically reviewed under TAP A-12.
TOPIC V-1:	COMPLIANCE WITH CODES AND STANDARDS
COMMENTS:	The Engineering Branch, DOR, is performing a generic review of all plants for compliance with inspection requirements of 10 CFR 50.55a(g).
TOPIC V-3:	OVERPRESSURE PROTECTION
COMMENTS:	Listed as TASK A-26 in NUREG-0371, "TASK ACTION PLANS FOR GENERIC ACTIVITIES", Published date November 1978. Generic letters issued to PWR facilities in August 1976. Specific criteria has been identified to be used in the design of modifications intended to preclude exceeding the limits of 10 CFR 50, Appendix G.
TOPIC V-4:	PIPING AND SAFE END INTEGRITY
COMMENTS:	Included in the review for 10 CFR 50.55a.
TOPIC V-7:	REACTOR COOLANT PUMP OVERSPEED
COMMENTS:	Listed as TASK B-68 in NUREG-0371, dated November 1978. At this time no criteria has been developed for this task.
TOPIC V-8:	STEAM GENERATOR INTEGRITY
COMMENTS:	Listed as TASK A-3, 4, 5 of NUREG-0317, dated November 1978. The TASK ACTION PLAN mpletely envelopes the scope of this topic review.
TOPIC V-13:	WATER HAMMER
COMMENTS:	Listed as TASK A-1 in NUREG-0371, "TASK ACTION PLANS FOR GENERIC ACTIVITIES", Published date November 1978. Generic letter sent to PWR facilities, requirements not established for BWRs.

November 16, 1979

TOPIC VI-2-B: SUBCOMPARTMENT ANALYSIS

COMMENTS: Listed as TASK A-2 in NUREG-0371, "TASK ACTION PLANS FOR GENERIC ACTIVITIES", Published date November 1978. Guidance letters issued to PWR licensees October 1975. The staff is currently developing plans for expanding this activity to resolve this issue for BWR facilities (NUREG-0510). Specific requirements and scope have not been established.

TOPIC VI-6: CONTAINMENT LEAK TESTING

COMMENTS: Reviewed under TAP A-23.

TOPIC VI-7-A.2: UPPER PLENUM INJECTION

Generic review of all Westinghouse two loop plants by Analysis Branch.

TOPIC VI-7.A.4: CORE SPRAY NOZZLE EFFECTIVENESS

COMMENTS: Listed as TASK A-16 in NUREG-0371, "TASK ACTION PLANS FOR GENERIC ACTIVITIES", Published date November 1978. December 1976 - letter issued to licensee.

TOPIC VI-7-D: LONG TERM COOLING PASSIVE FAILURES

COMMENTS: Generically reviewed and determination as stated in NUREG-0138.

TOPIC VI-7-E: ECCS SUMP DESIGN

COMMENTS: Reviewed under TAP A-43.

TOPIC VII-1-B: TRIP UNCERTAINTY

COMMENTS: Staff evaluations, issued August 1978, state that review is being pursued independent of SEP to determine impact of instrument error and drift upon safety margins of trip setpoints, and that appropriate actions will be taken to assure that adequate safety margins are maintained.

TOPIC VII-4: FAILURES OF NON-SAFETY SYSTEMS AND SELECTED ESF's

COMMENTS: The scope of this topic is contained in TASK A-17 of NUREG-0371, November 1978. The staff is developing a method of review. Criteria has not been established for implementation.

TOPIC VII-5: INSTRUMENTS FOR MONITORING ACCIDENTS

COMMENTS: TASK A-34 of NUREG-0371, November 1978. Criteria under development.

TOPIC VII-6:	FREQUENCY DECAY
COMMENTS:	The scope of this topic is completely addressed in TASK A-35 (2.C-10) of NUREG-0371, November 1978.
TOPIC VIII-1-A:	EFFECTS OF DEGRADED GRID VOLTAGE
COMMENTS:	The scope of this topic is contained in TASK A-35 (C-2, 3, 4, and 5) of NUREG-0371, November 1978. Initial letters sent to licensee August 1976.
TOPIC IX-2:	OVERHEAD HANDLING SYSTEMS - CRANES
COMMENTS:	Reviewed under TAP A-36.
TOPIC IX-6:	FIRE PROTECTION
COMMENTS:	This topic is being reviewed outside the SEPB as part of the ongoing licensing review implemented as a result of the Browns Ferry incident.
TOPIC XI-1:	APPENDIX I
COMMENTS:	This topic is part of an ongoing licensing review for all facilities to implement the limits of the Appendix I to 10 CFR 50.
TOPIC XI-2:	RADIOLOGICAL MONITORING SYSTEMS
COMMENTS:	Listed in NUREG-0371, November 1978, as TASK B-67, criteria and scope of review under development.
TOPIC XIII-1:	CONDUCT OF OPERATIONS
COMMENTS:	Generically reviewed by DPM with the exception of "operating experience" which will be provided by I&E.
TOPIC XIII-2:	SAFEGUARDS/INDUSTRIAL SECURITY
COMMENTS:	Ongoing licensing review to implement the requirements of 10 CFR 73.55.
TOPIC XV-21:	SPENT FUEL CASK DROP
COMMENTS:	Reviewed under TAP A-36.
TOPIC XV-22:	ANTICIPATED TRANSIENTS WITHOUT SCRAM
COMMENTS:	TASK A-9 of NUREG-0371, November 1978, criteria for implementation under development.
TOPIC XV-23:	STEAM GENERATOR MULTIPLE TUBE FAILURES
COMMENTS:	This topic is being considered in conjunction with TASK A-2, 3, 4 of NUREG-0371. No criteria has been established on this topic.

TOPIC XV-24:	LOSS OF ALL AC POWER
COMMENTS:	Reviewed under TAP A-44.
TOPIC XVII:	QA FOR OPERATIONS
COMMENTS:	Reviewed by QAB for conformance with 10 CFR Appendix B.

ENCLOSURE 2

R. E. GINNA

SEP TOPICS NOT APPLICABLE TO R. E. GINNA

TOPIC NO.	TITLE	COMMENTS
II-4-E	Dam Integrity	N/A to this unit site
III-7.A	Inservice Inspection, Including Prestressed Concrete Containments With Either Grouted or Ungrouted Tendons	N/A No Current Criteria
III-10-C	Surveillance Requirements on BWR Recirculation Pumps	N/A BWR Safety Topic
IV-3	BWR Jet Pump Operating Indications	N/A BWR Safety Topic
V-2	Applicability of Code Case	N/A at this time. To be reviewed for any future modifications using references to Code Cases.
V-9	Reactor Core Isolation Cooling System	N/A BWR Safety Topic
V-12.A	Water Purity of BWR Primary Coolant	N/A BWR Safety Topic
VI-2.A	Pressure Suppression BWR Containments	N/A BWR Safety Topic
VI-2-C	Ice Condenser Containment	N/A to this unit containment design
VI-7-A-4	Core Spray Nozzle Effectiveness	N/A BWR Safety Topic
VI-7-C-3	Effect of PWR Loop Isolation Valve Closure During A LOCA on ECCS	N/A to this unit site
VI-9-A	Main Steam Line Isolation Seal System	N/A BWR Safety Topic
VI-10-B	Shared Engineer Safety Features	N/A to this unit site
VII-7	Acceptability of Swing Bus Design on BWR-4 Plants	N/A BWR Safety Topic
Group I (BWR) DBE	All	N/A BWR DBE Review
Group VI DBE	Topic XV-13 (only) Uncontrolled Rod Assembly Withdrawal at Power, Low Power Startup, Rod Drop Accident	N/A BWR DBE Review

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

February 19, 1982

Docket No. 50-244
LS05-82- 02-079

Mr. John E. Maier, Vice President
Electric and Steam Production
Rochester Gas & Electric Corporation
89 East Avenue
Rochester, New York 14649

Dear Mr. Maier:

SUBJECT: SEP SAFETY TOPICS II-4.D, STABILITY OF SLOPES AND II-4.F, SETTLEMENT OF FOUNDATIONS AND BURIED EQUIPMENT - R. E. GINNA PLANT

We have completed our review of the subject two topics of R. E. Ginna Nuclear Power Plant. Enclosed is a copy of our Safety Evaluation Reports of these two topics. As discussed in our evaluation for Topic II-4.D, Stability of Slopes, the NRC cannot conclude that on site slopes are stable since the tested shear strength of soils from on-site borings was not used in your calculations and the reported values of shear strength were low.

This evaluation will be a basic input to the integrated safety assessment for your facility unless you identify changes needed to reflect the as-built conditions at your facility. This topic assessment may be revised in the future if your facility design is changed or if NRC criteria relating to this topic are modified before the integrated assessment is completed.

Sincerely,

Dennis M. Crutchfield

Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
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SYSTEMATIC EVALUATION PROGRAM
TOPIC II-4.F

R. E. GINNA

TOPIC: II-4.F, Settlement of Foundations and Buried Equipment

I. INTRODUCTION

In order to assure that safety related structures, systems and components are adequately protected against excessive settlement of the foundations, an evaluation should be made on the settlement and differential settlement of the foundations. The scope of this safety topic evaluation is to review the information submitted by the licensee including existing settlement data, geotechnical soil properties at the site, ground water table, etc. and, using current review criteria as a basis to evaluate the effect of existing settlement, if any, on safety related structures and the possibility of future settlement on the safety related structures.

II. CURRENT REVIEW CRITERIA

The current review criteria for this specific safety topic are:

1. SRP 2.5.4
2. Appendix A to 10 CFR Part 100
3. NAVFAC DM-7

III. RELATED SAFETY TOPICS AND INTERFACES

None

IV. EVALUATION

From the information provided by the licensee (References 1 and 2), the following findings are identified:

1. The containment, the auxiliary, and the intermediate buildings are founded on the bedrock of the Queenstone Formation.

2. The control and diesel generator buildings are founded on lean concrete placed over the bedrock.

3. The buried service water pipeline are founded on granular fill compacted to at least 95 percent of maximum density at optimum moisture content as determined in accordance with modified AASHO procedure.

V. CONCLUSION

Based on the evaluation discussed above, the staff concluded that the settlement of foundations and buried equipment is not a safety concern at the Ginna plant.

REFERENCES

1. Letter from J. Maier, RG&E to D. Crutchfield, NRC dated June 30, 1981.

2. Letter from J. Maier, RG&E to D. Crutchfield, NRC dated January 15, 1982.

SYSTEMATIC EVALUATION PROGRAM
TOPIC II-4.D

R. E. GINNA

TOPIC: II-4.D, Stability of Slopes

I. INTRODUCTION

In order to assure that all safety related structures, systems and components are adequately protected against the failure of natural or man-made slopes, the possibility of movement of these slopes is evaluated by comparing forces resisting failure to those causing failure. The scope of this safety topic evaluation is to review the condition of existing slopes, including geotechnical properties, ground water table, etc. and, using current review criteria as a basis, to evaluate adequacy of these slopes.

II. CURRENT REVIEW CRITERIA

The current review criteria for this specific safety topic are:

1. NAVFAC DM-7
2. SRP 2.5.5
3. Appendix A to 10 CFR Part 100

III. RELATED SAFETY TOPICS AND INTERFACES

None

IV. EVALUATION

From the information provided by the licensee (References 1 and 2), the following findings are identified:

1. The licensee has identified two onsite slopes, whose failures may be of safety concern.

2. The subsurface conditions beneath the first slope, located about 200 feet northwest of the Turbine Building, can be assumed to be the same as those shown on Boring 1.

3. The subsurface conditions beneath the second slope, located east of the Screen House, can be assumed to be the same as those shown on Boring 3.

4. The licensee has assumed that the silty clay layer has a friction angle of 32 degrees and concluded that these two slopes are sufficiently stable. However, the licensee has not provided an adequate basis to support its assumption and conclusion.

5. These two slopes are located in silty clay soils with reportedly low shear strengths: about 2 psi for silty clay shown on Boring 1 and about 1 psi for silty clay shown on Boring 3. The evaluation of stability of these two slopes should be based on the tested shear strength of the two boring samples.

V. CONCLUSION

Based on the evaluation discussed above, the staff cannot conclude that the onsite slopes are stable and recommends; (1) additional site investigation in vicinity of safety related slopes and an analysis of slope stability based upon in-situ soil properties or (2) a justification that slope instability or failure would not adversely affect the ability to safely shutdown the plant.

REFERENCES

1. Letter from J. Maier, RG&E to D. Crutchfield, NRC dated June 30, 1981.

2. Letter from J. Maier, RG&E to D. Crutchfield, NRC dated January 15, 1982.

July 9, 1981

Docket No. 50-244
LS05-81-07-014

Mr. John E. Maier, Vice President
Rochester Gas & Electric Corporation
89 East Avenue
Rochester, New York 14649

Dear Mr. Maier:

SUBJECT: SEP REVIEW TOPICS II-4, GEOLOGY AND SEISMOLOGY AND II-4.B, PROXIMITY OF CAPABLE TECTONIC STRUCTURES IN PLANT VICINITY

Enclosed is a copy of our evaluation for Systematic Evaluation Program Topics II-4, "Geology and Seismology," and II-4.B, "Proximity of Capable Tectonic Structures in Plant Vicinity." These assessments compare your site condition, as described in the docket and references with the criteria currently used by the staff for licensing new facilities. Please inform us if your site condition differs from the licensing basis assumed in our assessments.

Our review of these topics is complete and this evaluation will be a basic input to the integrated safety assessment for your facility unless you identify changes needed to reflect the existing site condition at your facility. These topic assessments may be revised in the future if NRC criteria relating to these topics are modified before the integrated assessment is completed.

Sincerely,

Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

SE04
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DSU USE EX(07)

OFFICE	SEPB:DL	SEPB:DL	SEPB:DL	ORB#5:DL:PM	ORB#5:DL:C	AD:SA:DL	
SURNAME	TCheng:dk	RHermann	WRussell	RSnaider	DCrutchfield	GLainas	
DATE	6/24/81	6/24/81	6/24/81	6/25/81	7/8/81	7/8/81	

Mr. John E. Maier

cc
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SEP SAFETY TOPIC EVALUATION

R. E. GINNA NUCLEAR POWER PLANT

TOPIC II-4, GEOLOGY AND SEISMOLOGY

Introduction

During the time frame when SEP plants were designed, the licensees, because compliance with Regulatory Guide 1.70 was not required, usually provided only very minimal information in geologic and seismologic areas. Therefore, in order to assess the adequacy of the design of these older plants with respect to local geologic and seismologic phenomena, a re-review was necessary. The scope of this topic review included surface faulting, potential landslides, ground collapse, possibility of liquefaction, etc.

Review Criteria

1. Standard Review Plan Sections 2.5.1, 2.5.2, 2.5.3, 2.5.4 and 2.5.5
2. Appendix A to 10 CFR Part 100

Related Safety Topics and Interfaces

The related safety topics are II-4.A, II-4.B, and II-4.C. The conclusion from each of these sub-topics form a part of the overall conclusion for this topic, i.e., site specific ground response spectrum for this site.

Evaluation

The geology and seismology of the Ginna site were first reviewed in 1965 and 1966 by the Atomic Energy Commission (AEC) and its advisors, the U. S. Geological Survey (USGS) and the Environmental Science Services Administration (ESSA) of the Coast and Geodetic Survey. In its report the USGS concluded that a relationship between seismicity and mapped faults had not been demon-

strated within the area. The ESSA concluded after its review of the regional seismicity that the plant should be designed for a moderately strong earthquake having an acceleration of approximately 0.20g without loss of function of components important to safety.

Recently, as a part of the SEP, a re-review of the seismological hazard at the Ginna site was conducted through the Site Specific Spectra Program for the Eastern United States SEP facilities. The current recommendation for the seismic input ground motion was transmitted to the SEP Owners in a letter from D. M. Crutchfield, dated June 17, 1981. In Attachment 2 to the letter, a memo from the Geosciences Branch, Division of Engineering, entitled, "Final Review and Recommendations for Site Specific Spectra at SEP Sites," the following conclusion was drawn:

> "Based upon our ongoing review of site geology to satisfy SEP Topics II-4: Geology and Seismology, and II-4.B; Proximity of Capable Structures to the Site, we do not anticipate that our final review of these topics will have any impact upon the recommended spectra."

The geology of the site was re-assessed by the AEC staff when Rochester Gas & Electric Corporation (RG&E) applied for a full term license in August 1972. At that time RG&E reported the discovery of faults adjacent to Ginna during investigations for an alternate site for its Sterling Power Project. We reviewed the available data concerning these faults and concluded that they were not capable within the meaning of Appendix A, 10 CFR Part 100.

Other new information that we became aware of since the CP review was the existence of relatively high residual stresses in bedrock in the Lake Ontario region (Fitzpatrick PSAR and FSAR, Sbar and Sykes, 1973, and Dames and Moore,

1978, Nine Mile Point Geologic Investigations). We have reviewed the available data and conclude that if such stresses were present at the Ginna site they were most likely relieved during excavation and construction and do not represent a problem to the plant. In response to staff questions RG&E confirmed that during the life of the plant there have been no occurrences such as cracked walls or foundations that can be attributed to high stresses in bedrock.

During the SEP geological review of the Ginna site the staff reviewed the following materials: the Ginna PSAR, SER, Dames and Moore Geological and Geophysical Investigations Ginna Site, Dames and Moore Geologic Investigations Nine Mile Point Unit 2, aerial photographs, topograhic maps, and selected documents from the open literature (a list of references is at the end of this chapter).

The following paragraphs present a brief description of the regional and site geology.

The site is located on the southern shore of Lake Ontario in the eastern portion of the Erie-Ontario Lowlands Physiographic Province (Fenneman, 1938). The regional topography is of low relief and rises gradually from an elevation of +250 msl at the lake to +500 at the Portage Escarpment which is the northern boundary of the Appalachian Plateau Province to the south. A beach ridge 10 to 25 feet high parallels the shoreline of Lake Ontario 4 miles to the south. North of the ridge is the lake plain of former glacial Lake Iroquois. The site lies on this plain.

The southern margin of Lake Ontario is characterized by many promontories which seem to reflect prominent joint directions in bedrock. The site is located

near one such promontory called Smokey Point. Major joint directions are N 75° to 85°E and N10°E to 30°W. Erosional bluffs along the lake range from 15 to 30 feet high. Smokey Point is located at the eastern end of a 5 mile long ridge, the crest of which is about +310'. Relief in the site area is low with elevations ranging from +360 to +300. The site is underlain by 20 to 60 feet of glacial deposits, and approximately 2700 feet of Paleozoic (570 million years before present mybp to 225 mybp) sedimentary rocks over crystalline basement. The uppermost Paleozoic unit is sandstone of upper Ordovician (455 to 430 mybp) Queenston Formation.

The glacial deposits include at least two till horizons. The lower unit overlies bedrock and varies in thickness from 6 to 25 feet. This unit consists of grayish red, calcarous, silty clay. The unit is poorly sorted and contains numerous striated and faceted pebbles, cobbles and boulders. The upper till unit is at or near the ground surface and ranges from 7 to 30 feet in thickness. This unit is composed of relatively uniform olive gray to yellow brown silty, sandy clay, with large boulders several feet in diameter. Between the two till horizons is a zone of lakebed deposits consisting of gray, very plastic clay.

RG&E has determined by regional correlation that the lower till unit is associated with the Woodfordian glacial advance, a substage of the Wisconsinan Stage, which took place about 22,000 years ago. The lakebed deposit is believed to have been deposited in the bed of Lake Iroquois. The upper till is related to a minor glacial readvancement that occurred about 12,000 years ago. The staff has examined the evidence and agrees with the licensee's interpretation.

Conclusion

Based on the information provided in the references, the acceptable conclusions of Topics II-4.A, II-4.B, and II-4.C and the evaluation stated above, we conclude that the information used for developing site specific spectra is adequate and have re-affirmed that local geologic and seismologic phenomena will not affect the plant.

REFERENCES

Dames and Moore, 1978, Nine Mile Point Nuclear Station, Unit 2 Geologic Investigations, for Niagara Mohawk Power Corporation.

Dames and Moore, 1974, Geologic and Geophysical Investigations Ginna Site, Ontario, New York, for Rochester Gas and Electric Corp.

Dames and Moore, 1965, Site Evaluation Study, Proposed Brookwood Nuclear Power Plant, Ontario, New York, Rochester Gas and Electric Corp.

Environmental Science Services Administration, 1966 Report on the Seismicity of the Rochester, New York Area, 16 Feb. 1966 letter to H. L. Price, USAEC from J. C. Tilson, ESSA.

Fakundiny, R.H., P.W. Pomeroy, J. W. Pferd, T. A. Nowak, Jr., and J. C. Meyer, 1978, Structural Instability Features in the Vicinity of the Clarendon Linden Fault System, Western New York and Lake Ontario, New York State Mes/um

Fenneman, N.M., 1938, Physiography of Eastern United States, McGraw Hill Book Co., New York, 534 pp.

Flint, R.F., 1971, Glacial and Quaternary Geology, John Wiley and Sons, Inc., New York 892 pp.

New York State Electric and Gas Corporation, 1979, Preliminary Safety Analysis Report New Haven Nuclear Site, Appendix 2.5.

Power Authority State of New York, 1972, James A. Fitzpatrick Nuclear Power Plant Final Safety Analysis Report.

Rochester Gas and Electric Corporation, Robert Emmett Ginna Nuclear Power Plant Unit NO. 1. Final Facility Description and Safety Analysis Report.

Sbar, M.L. and L. R. Sykes, 1973, Contemporary Compressive Stress and Seismicity in Eastern North America: An Example of Intra-plate Tectonics, Geol. Soc. Amer. Bull. vol. 84, pp. 1861-1882.

Stone and Webster, 1978, Report of Fault Investigations at Fitzpatrick Nuclear Power Plant, for Power Authority of the State of New York.

U. S. Geological Survey, 1966, Geology and Hydrology of the Proposed Brookwood Nuclear Station No. 1 site, Wayne County, New York, 28 Feb., 1966 letter to H. L. Price, USAEC from the Acting Director USGS.

SEP SAFETY TOPIC EVALUATION

R. E. GINNA NUCLEAR POWER PLANT

TOPIC II-4.B, Proximity of Capable Tectonic Structures in Plant Vicinity

Introduction

In order to assure that the local geological features and the expected ground shaking characteristics will not endanger the safety of plant facilities, an evaluation should be made on the characteristics of local geological features. The scope of this topic evaluation is to review the existing information provided by licensee and to identify new features such as capable faults, etc.

Review Criteria

1. Standard Review Plan Section 2.5.2
2. Appendix A to 10 CFR Part 100

Related Safety Topics and Interfaces

The related safety topics are II-4, II-4.A and II-4.C. The results of this review topic may affect the conclusion drawn for these related topics, i.e., site specific ground response spectra developed for the SEP plants.

Evaluation

Within the Ontario Lowlands the nearest regional faulting is the Clarendon-Linden structure near Batavia, New York. The structure trends north-south and is about 35 miles west of Ginna. The fault is described (Fakundiny et al, 1978) as a complex faulted zone with major north-south set of subparallel normal and reverse faults that have a cumulative displacement of approximately 100 meters with east side up. Data suggests that the zone is continuous to the north across Lake Ontario for a total length of as much as 180 km.

Fakundiny et al (1978) found no unequivocal evidence of post glacial faulting among 36 faults, 6716 joints and 87 pop-ups studied around the Clarendon-Linden fault system. However, numerous earthquakes, including the 1929 Modified Mercalli Intensity VIII earthquake, have occurred within the fault system near Attica. A number of seismologists have concluded that these events are probably related to solution mining of salt.

The presence faults has been documented at the Nine Mile Point and Fitzpatrick nuclear sites approximately 50 miles east of Ginna. The structures are three west-northwest striking high angle faults, and several north-south striking thrust faults and folds. Displacements range from inches to several feet. Several of the faults mapped at Nine Mile Point, Unit 2 have been shown to have undergone some movement during the last 10,000 years. Although the NRC staff has not completed its review of these faults we have tentatively concluded that the most recent displacements are most likely associated with the complex phenomena caused by glacial loading and unloading. However, no such post Pleistocene faults have been identified at Ginna.

A structural complex was also discovered at the proposed New Haven site located a few miles east of Nine Mile Point. These structures consist of a large northeast striking anticline with several associated faults. The folds and faults were demonstrated by the applicant to be non capable within the intent of Appendix A (NYSE&G 1 and 2 PSAR).

Several minor normal faults with 2 to 15 feet of displacements have been identified between the site and northward projection of the Clarendon-Linden fault. There is no evidence that indicates post Pleistocene (less than 10 mybp) movement along these faults.

During an investigation conducted by Rochester Gas and Electric Company (RGE) in 1973 adjacent to the Ginna Nuclear site for an alternate site for the Sterling Power Project, evidence of faults was found in core borings. An extensive investigation program was carried out. The investigations included a large trench excavated across the fault zone, additional borings, petrofabric and minerological analyses, testing of samples from the fault zones, geophysical explorations, and surface geological mapping.

The studies revealed that the fault zone was comprised of three down-to-the-northeast faults that trended N65^{o}W. The maximum offset is about 26 feet which decreases to about 6 feet to the southeast near the plant. The fault zone passes about 30 feet southwest of the Reactor complex. Three geological reconaissanceswere made by a staff geologist to the site to review progress of the investigations and examine features exposed in trenches across the fault zone.

A large trench across the fault revealed extensive deformation of glacially deposited horizons but there was no deformation that was directly attributable to tectonc movement along the faults.

The strongest evidence that these deformations are not related to tectonic displacement on the bedrock faults is the presence of a horizontal unit at the base of the lower till which lies undisturbed across the southernmost fault, and stacking planes (imbricate thrust sheets caused by the southward advancement of the glacier) that cut across the faults without displacements.

RG&E also attempted to determine the age of fault gouge by radiometric techniques, but the results were unreliable. However, other lines of evidence indicate a much older age of last movement than Pleistocene. This evidence includes:

(1) the observation that the contemporary stress field is different from that in which the fault originated. According to Sbar and Sykes, 1973 the contemporary stress picture in Western New York is one of nearly horizontal compression oriented in an eastwest direction. Evidence for this is local squeeze and pop-up features and in-situ stress measurements in the region. The existing stress field is not consistent either in orientation or type of stress field in which the faults were formed, and the stress regime in which the faults were formed was essentially northeast-southwest and tensional.

(2) The presence of unsheared hydrothermal crystals within the fault zone demonstrate that faulting predates the hydrothermal event which deposited the crystals and this event probably occurred no later than the Cretaceous (65 million years ago). Analyses carried out by consultants to RG&E show that the mineralization of fluid inclusions in calcite crystals along with sulfide mineralization, particularly pyrrhotite and molybdenite, more than likely reflect hydrothermal mineralization at temperatures of at least 225° to $300^{o}C$. The last known tectonic environment within which such conditions could have developed in the area was about 65 million years ago.

(3) No recorded historic earthquake has occurred which could be associated with the faults.

We therefore conclude that the faults at least predate the latest major glacial advance which occurred about 22,000 years ago. The weight of all the available information indicates that the faults are more than 65 million years old.

Construction photographs of the Ginna excavation were examined by the staff. There were ample fair quality photos to cover most of the walls of the major excavation. Bedrock bedding could be clearly seen in many of the photographs, and, although there are numerous joints, there is no indication of displacement. We therefore, can conclude that there is no faulting directly beneath the major Category I structures of the plant.

Conclusion

Based on the information by the licensee and the analysis described above, we conclude that there are no capable faults in the vicinity of Ginna site, and that conclusions made during licensing reviews are still valid.

REFERENCES

Dames and Moore, 1978, Nine Mile Point Nuclear Station, Unit 2 Geologic Investigations, for Niagara Mohawk Power Corporation.

Dames and Moore, 1974, Geologic and Geophysical Investigations Ginna Site, Ontario, New York, for Rochester Gas and Electric Corp.

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