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Eastern United States Seismic Hazard Research

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Abstract

The United States Nuclear Regulatory Commission (NRC) supports a very productive research program that addresses the issue of seismic hazards to nuclear power plants (NPP's). Estimation of these hazards is a very significant factor in siting of NPP's and in evaluating the safety of existing plants. There is considerable uncertainty in estimating the seismic hazard particularly in the Eastern United States. The objectives of the NRC seismotectonic research program are to quantify and reduce the uncertainty in seismic hazard assessment and to develop methods of dealing with uncertainties.

Three of the principal contributors to the uncertainty in quantifying the seismic hazard at a site are: 1) the characteristics of the seismic source zone, 2) the propagation of seismic energy between the source and the site, and 3) the site response, including soil response. The relative levels of contribution of these three to uncertainty are region dependent. (For programmatic ease, the Eastern United States have been divided into four regions: Northeast, Southeast, New Madrid/Anna, Ohio, and Nemaha Ridge.) Currently, there is a reasonable level of confidence in a working hypothesis for the source of seismicity in the New Madrid area and a moderate understanding of the regional propagation characteristics. There are a number of hypotheses for the source of Southeastern seismicity including the Charleston, South Carolina, area. No generally accepted hypotheses are available for the Northeast or the Nemaha Ridge. There is a low level of knowledge about the propagation and site response characteristics in the East except as noted for the New Madrid region.

The programs concerning the quantification and reduction of uncertainty in seismic hazard assessment due to these three contributors are grouped into the regional program and the topical program. The regional program consists of the operating of seismographic networks and geophysical/geologic investigations of key areas, i.e., the collection and interpretation of a basic data set. The topical program consists of studies related to generic issues rather than source zone problems, such as the frequency dependence of the propagation.

A brief description of these two programs will compose the first third of this presentation.

The program related to dealing with the uncertainty generally involves probabilistic analysis of existing data sets. The principal projects in the program has been the "Seismic Hazard Characterization of the Eastern United States" conducted by Lawrence Livermore National Laboratory. The seismic hazard curves calculated were based upon expert opinion generated in the areas of seismicity and source zones and of seismic strong ground motion. Preliminary results from this study will be presented and discussed.

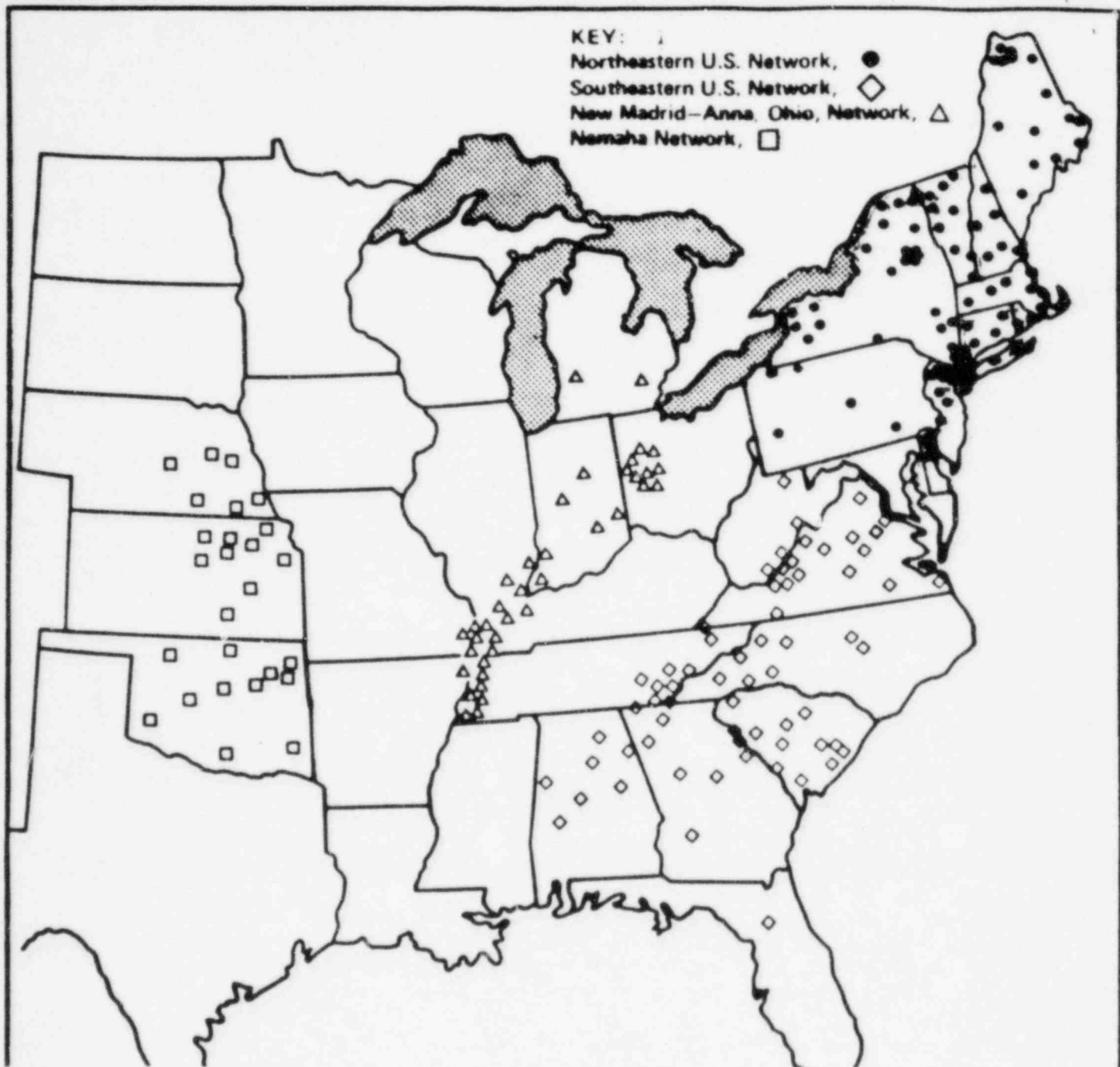
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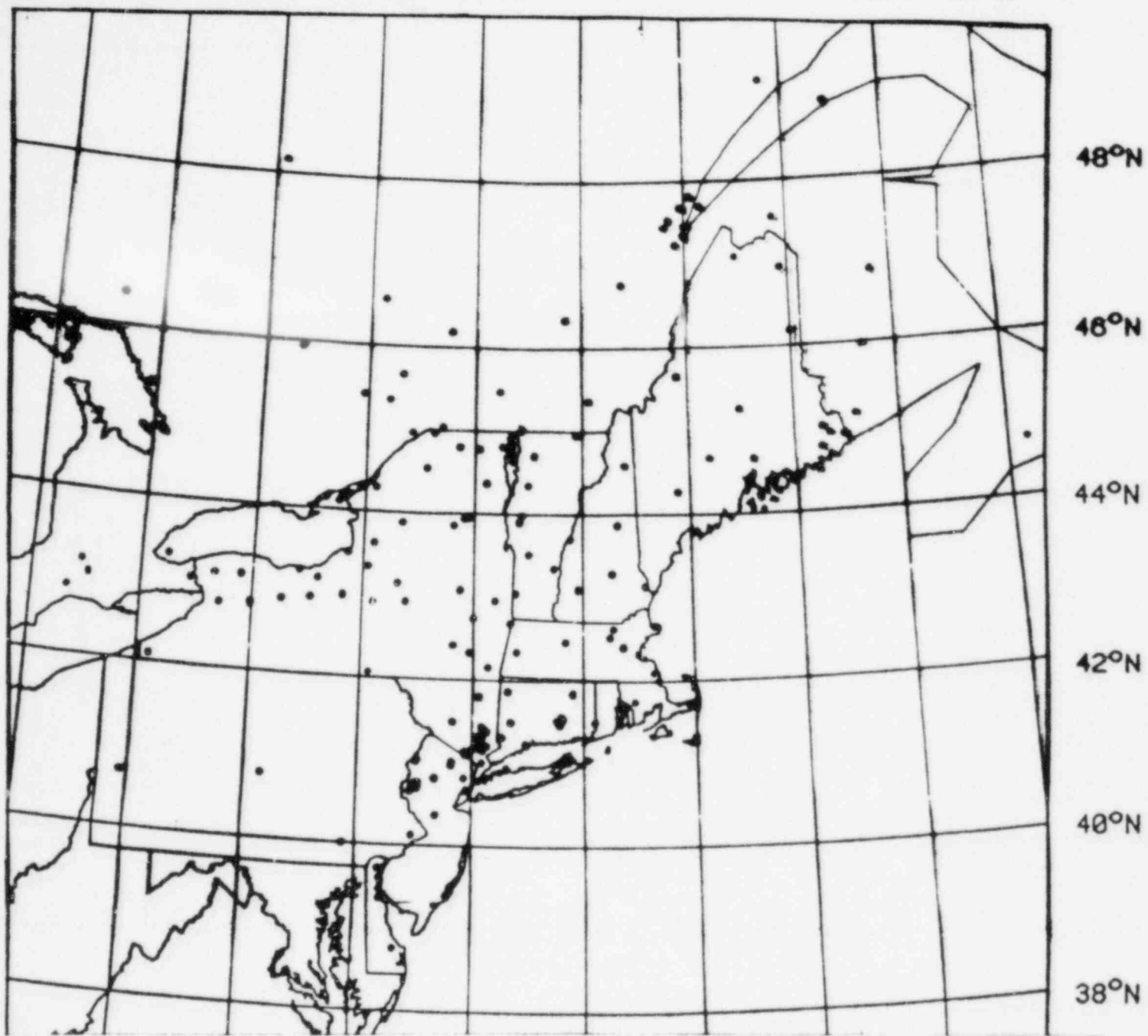
Northeastern U.S. Network, ●

Southeastern U.S. Network, ◇

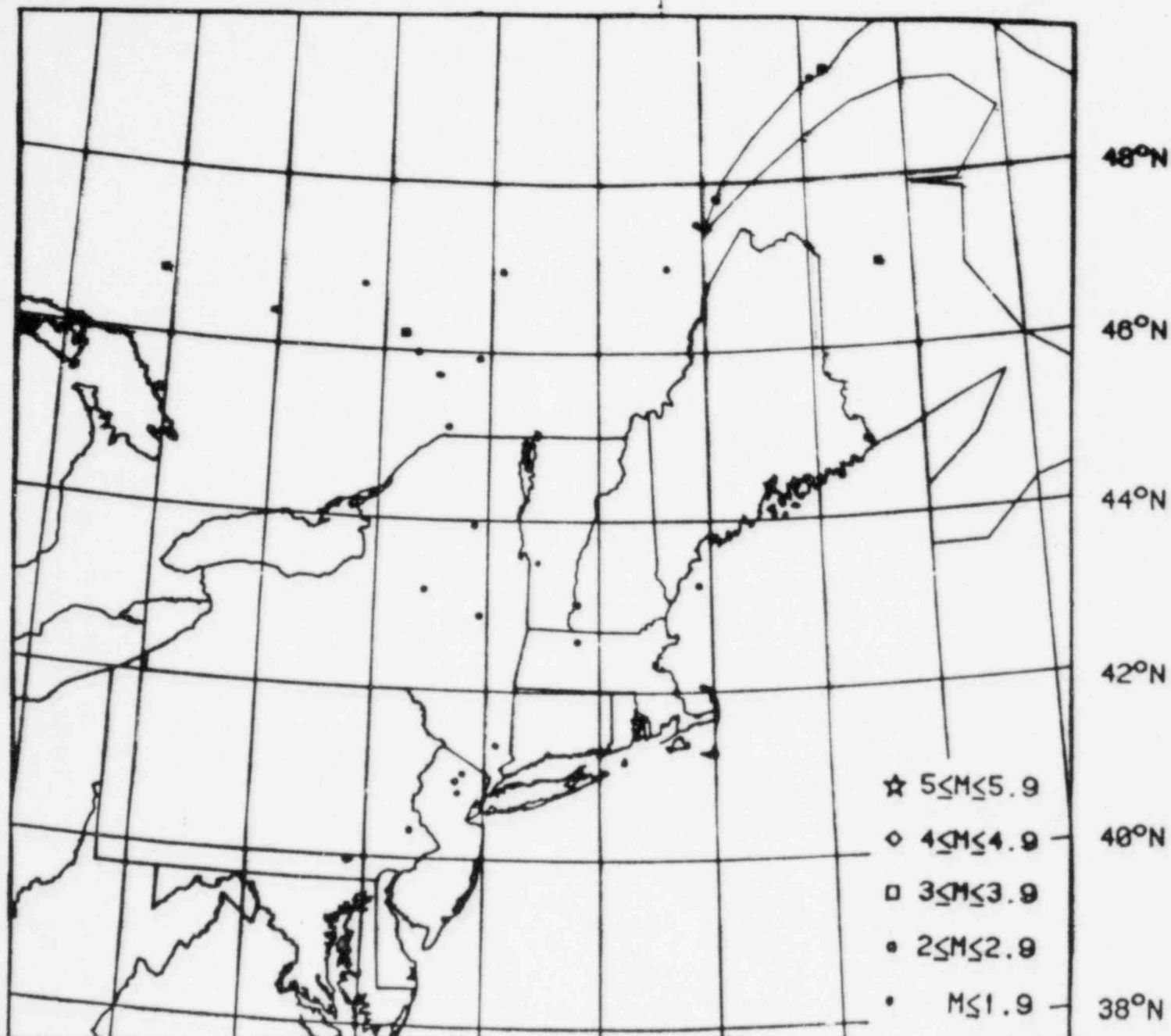
New Madrid-Anna, Ohio, Network, △

Nemaha Network, □

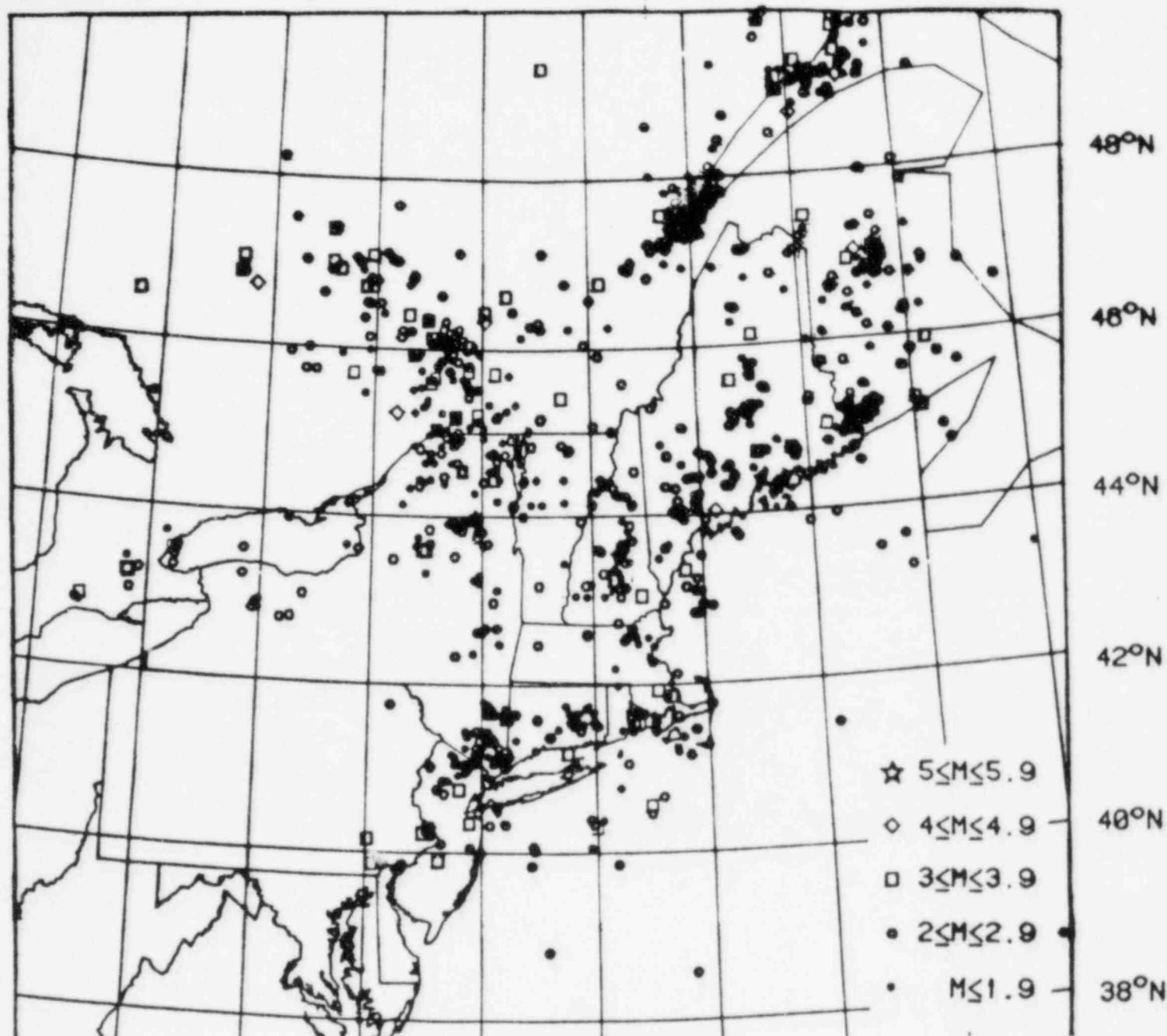


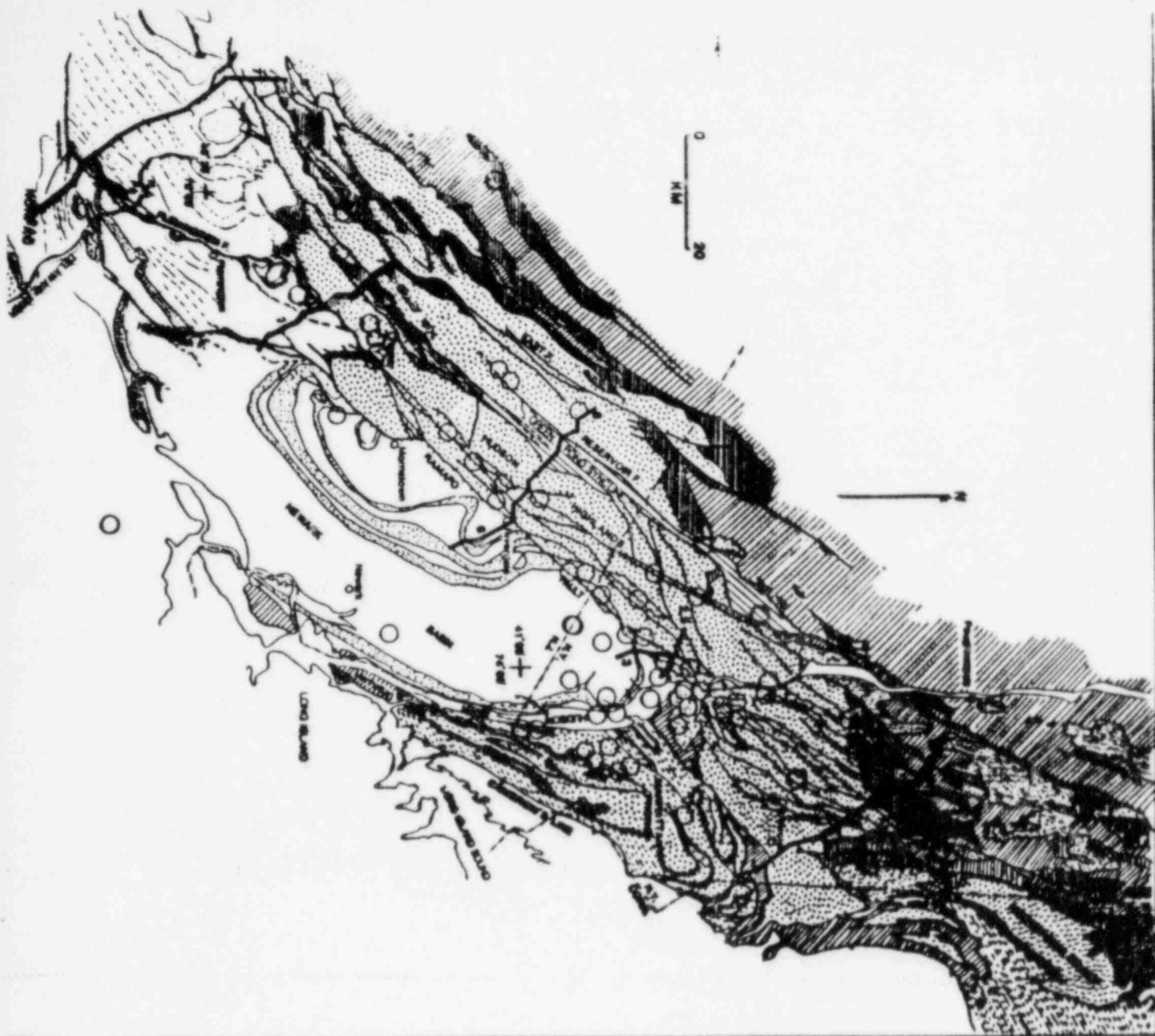


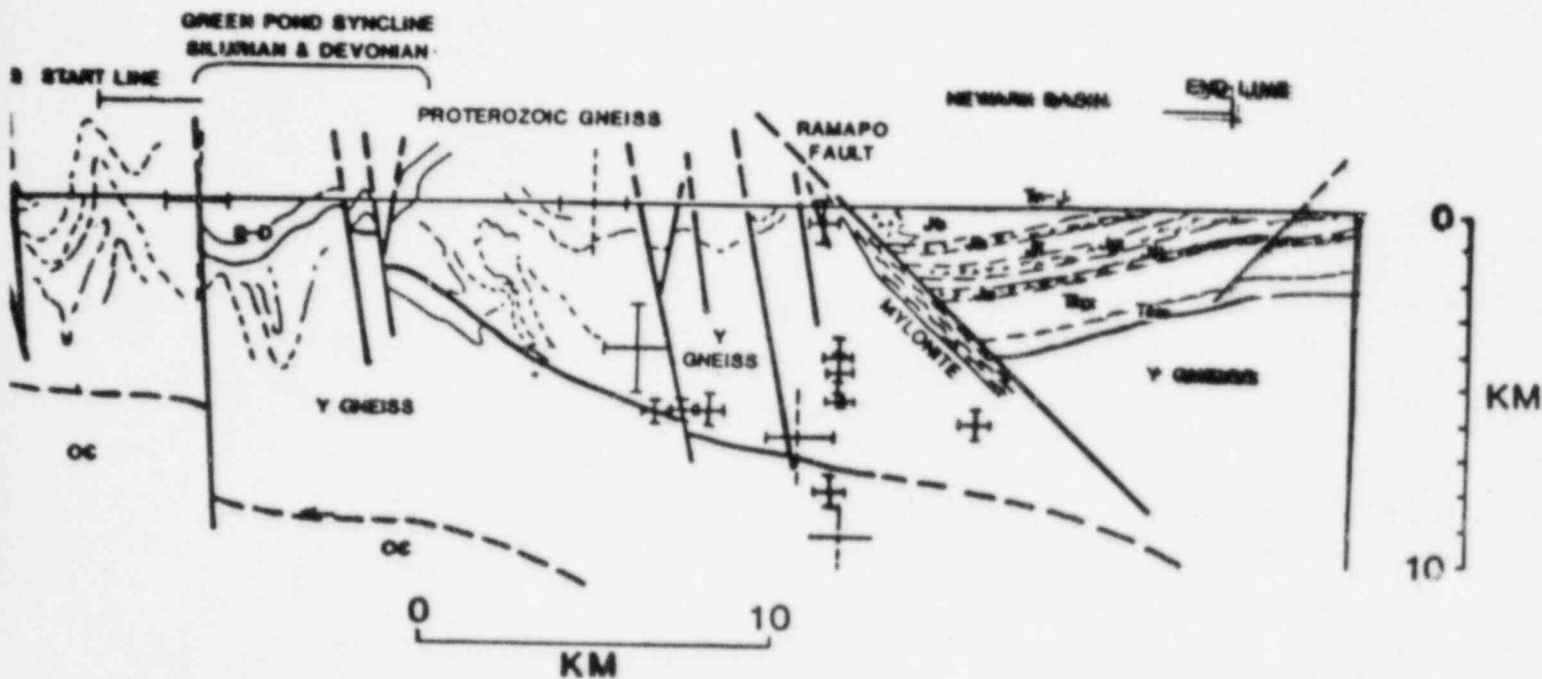
82°W 80°W 78°W 76°W 74°W 72°W 70°W 68°W 66°W 64°W



82°W 80°W 78°W 76°W 74°W 72°W 70°W 68°W 66°W 64°W







CROSS SECTION LINE 6 SHOWING HYPOCENTERS

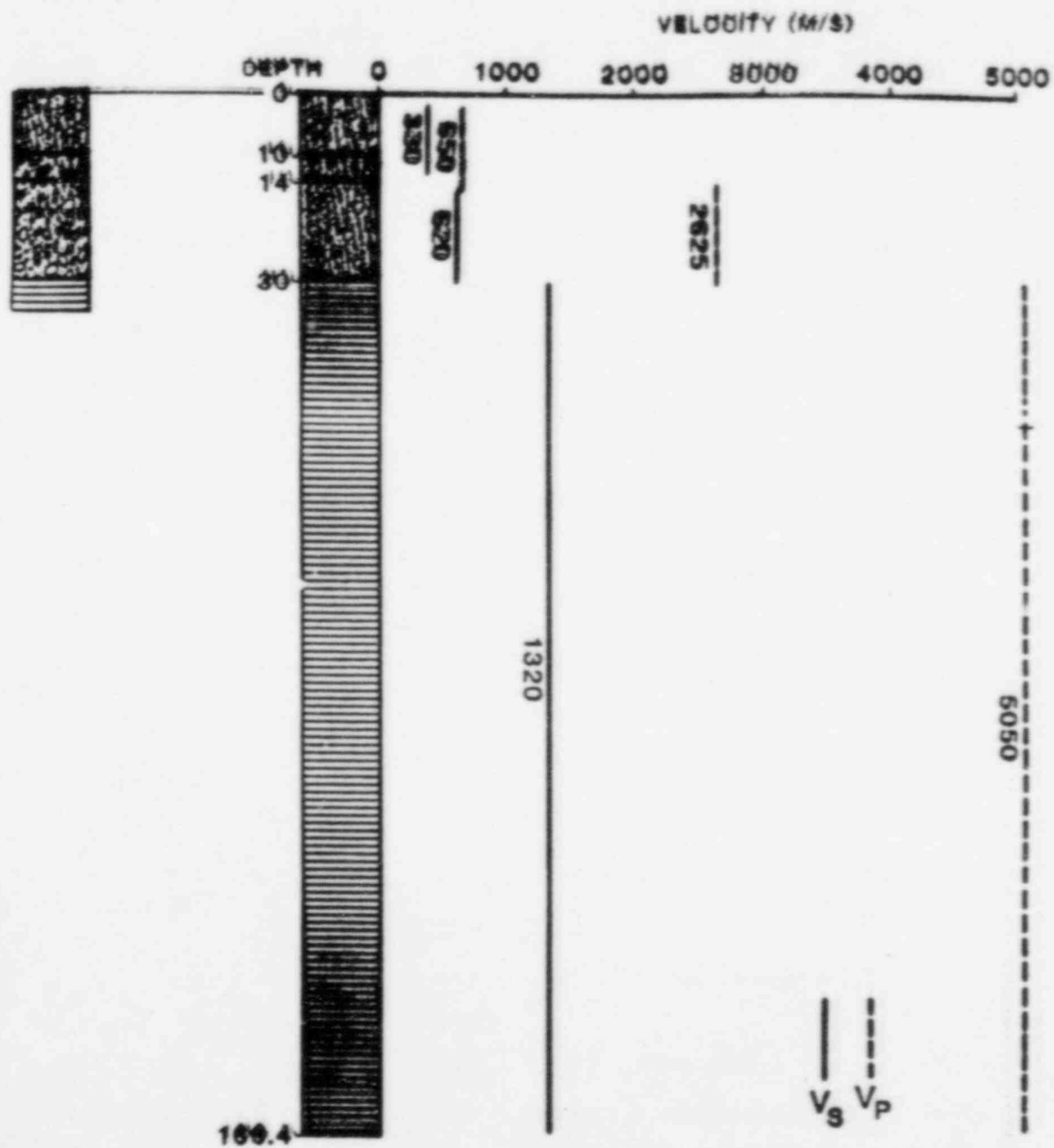


MODDUS, CONNECTICUT
SEISMIC ZONE (HOLES 3,4)

RAMAPO, NEW YORK
SEISMIC ZONE (HOLES 1,2,5)

CENTRAL VIRGINIA SEISMIC ZONE
(HOLES 6,7)

McGEE CREEK RECORDING SITE



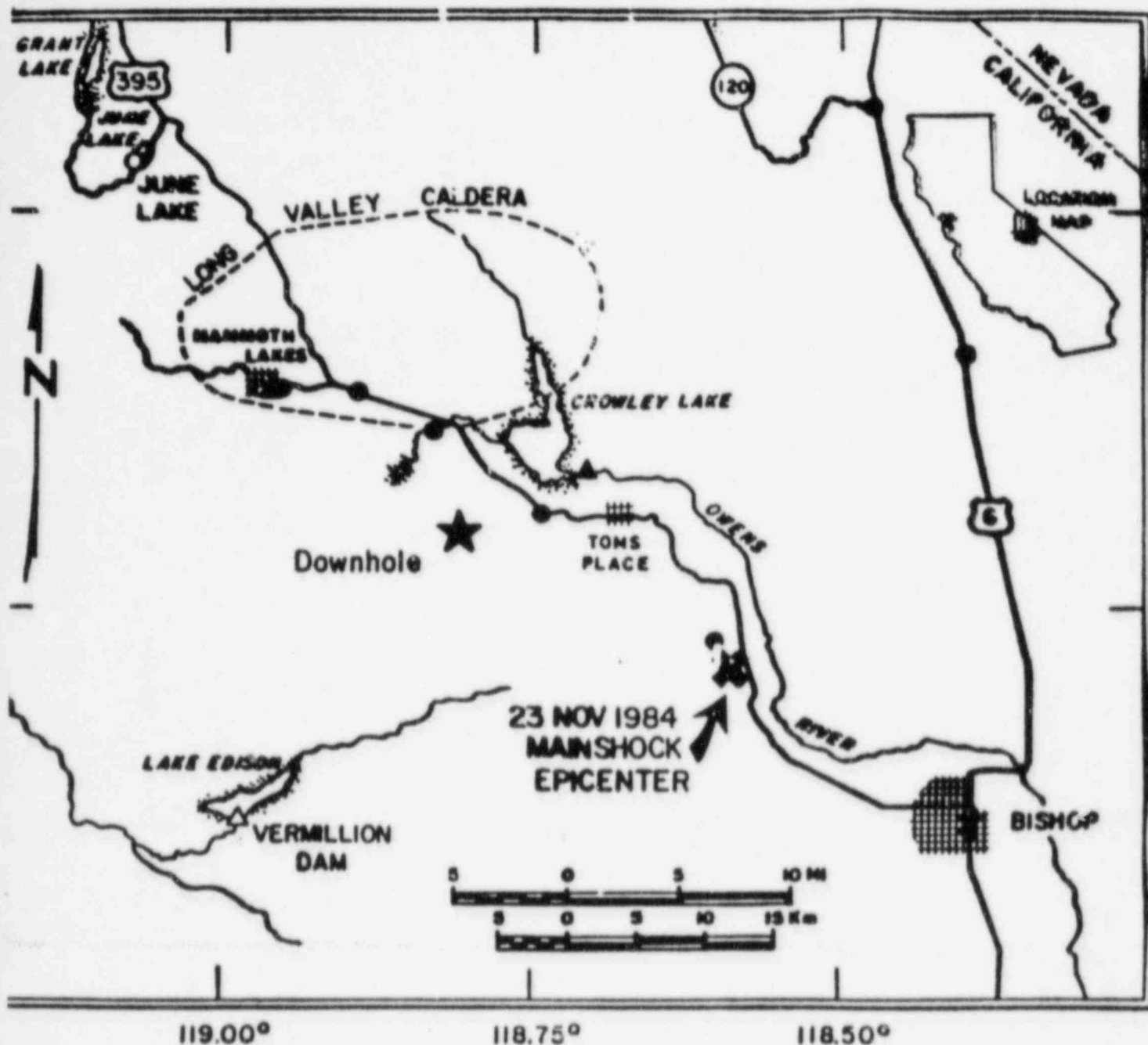


TABLE 2.1

List of Panels and Panel Members

EUS EGNATION AND SEISMICITY PANEL

Professor Oliber A. Bollinger

Mr. Richard J. Melt

Professor Arch C. Johnston

Dr. Alan L. Kafka

Professor James E. Lawson

Professor L. Tim Long

Professor Otto W. Nuttli

Dr. Paul W. Pomeroy

Dr. J. Carl Stepp

Professor Ronald L. Street

Professor M. Nafi Toksoz

EUS GROUND MOTION MODEL PANEL (G-Panel)

David M. Boore

Kenneth Campbell

Professor Otto W. Nuttli

Professor Nafi Toksoz

Professor Mihailo Trifunac

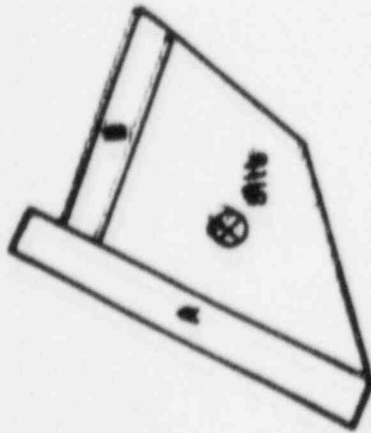
PEER REVIEW PANEL

Professor G.B. Baecher

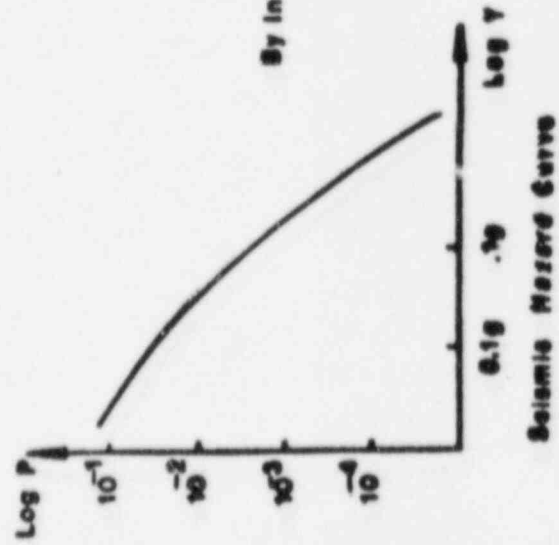
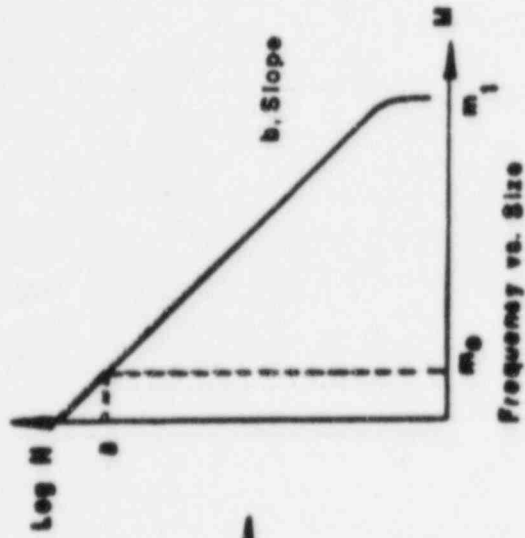
Professor J.E. Ebel

Professor L.T. Long

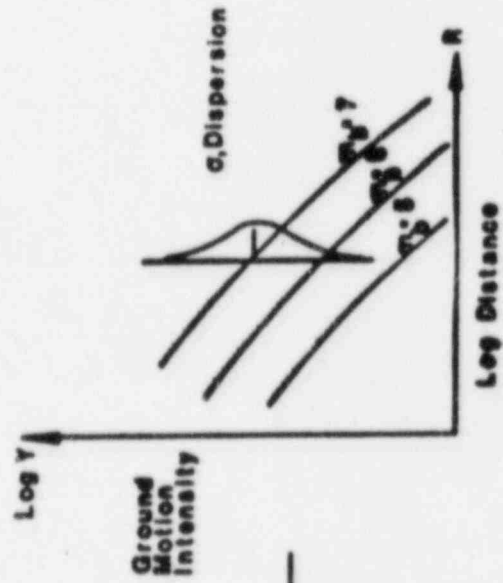
Professor D. Veneziano



Geometry of Homogeneous Source Zones (Seismicity/Tectonics)



Seismic Hazard Curve



Ground Motion Prediction

By Integration





Key to Site Index Numbers

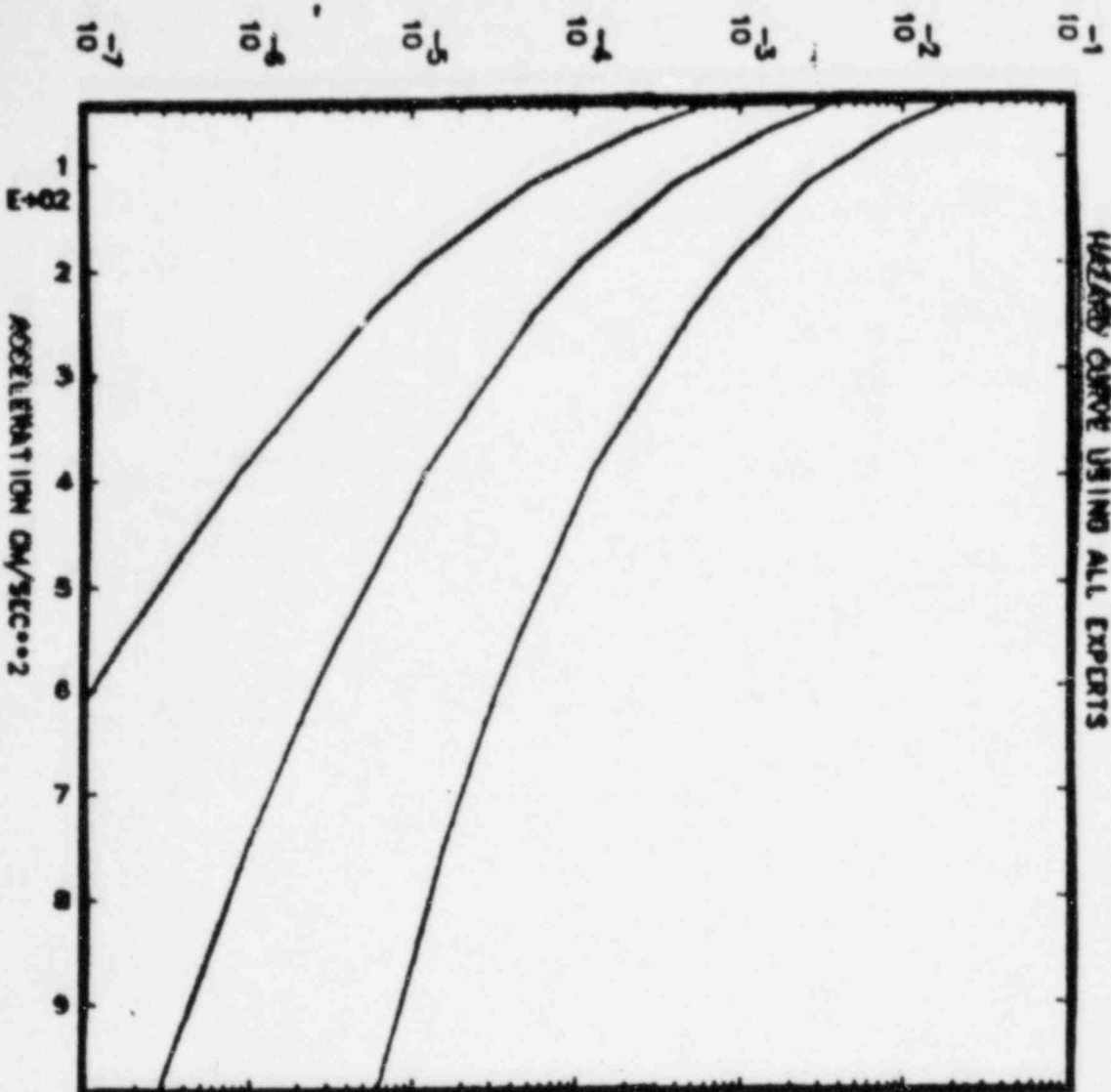
1. Limerick
2. Shannon Morris
3. Brackland
4. La Crosse
5. River Bend
6. Wolf Creek
7. Motts Bar
8. Vogtle
9. Millstone
10. Maine Yankee

Location of the Sample Sites
in the EUS

**U.S. SEISMIC HAZARD CHARACTERIZATION
INCLUDING SITE CORRECTION**

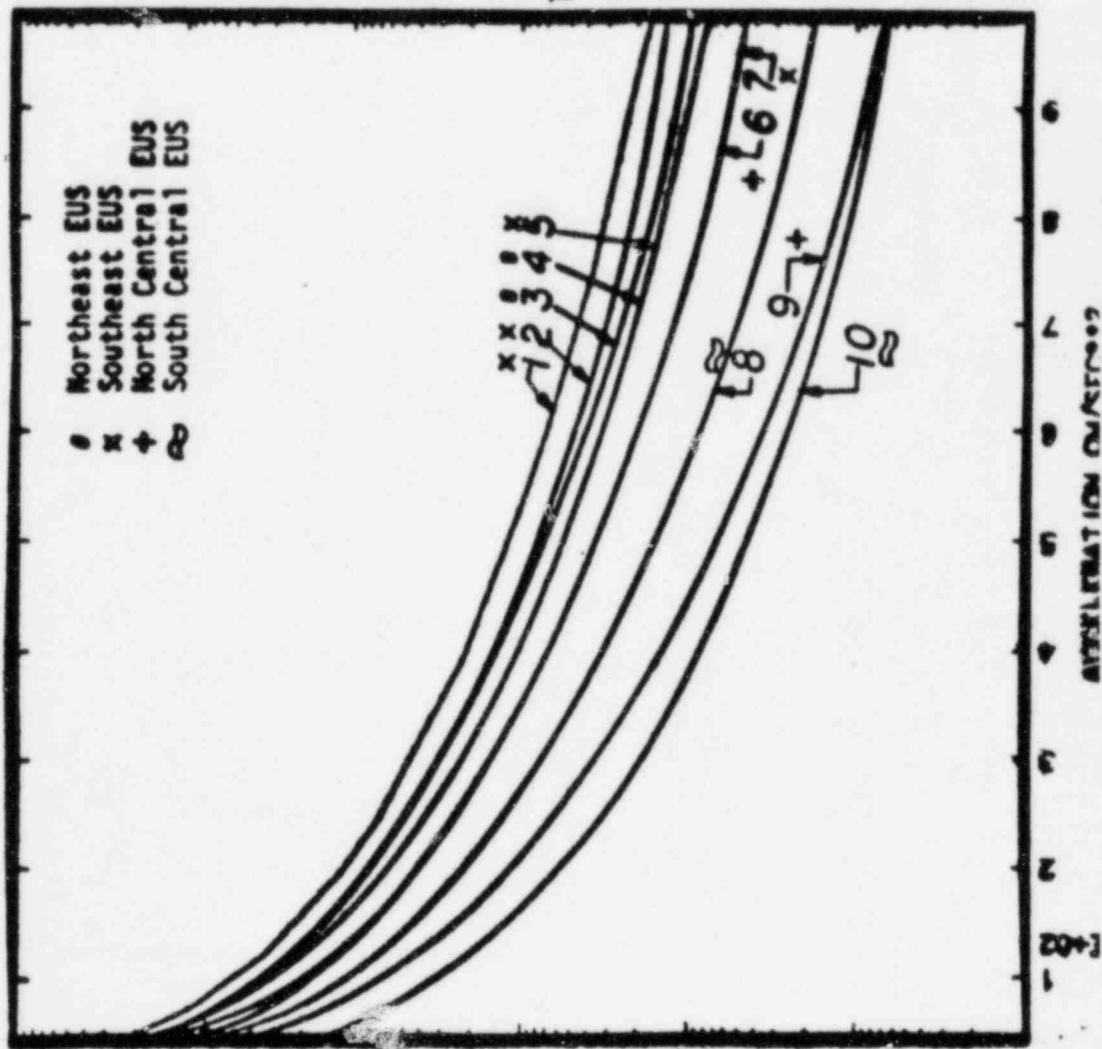
PERIODS = 18.0, 50.0 AND 85.0

HAZARD CURVE USING ALL EXPERTS



BRAIDWOOD

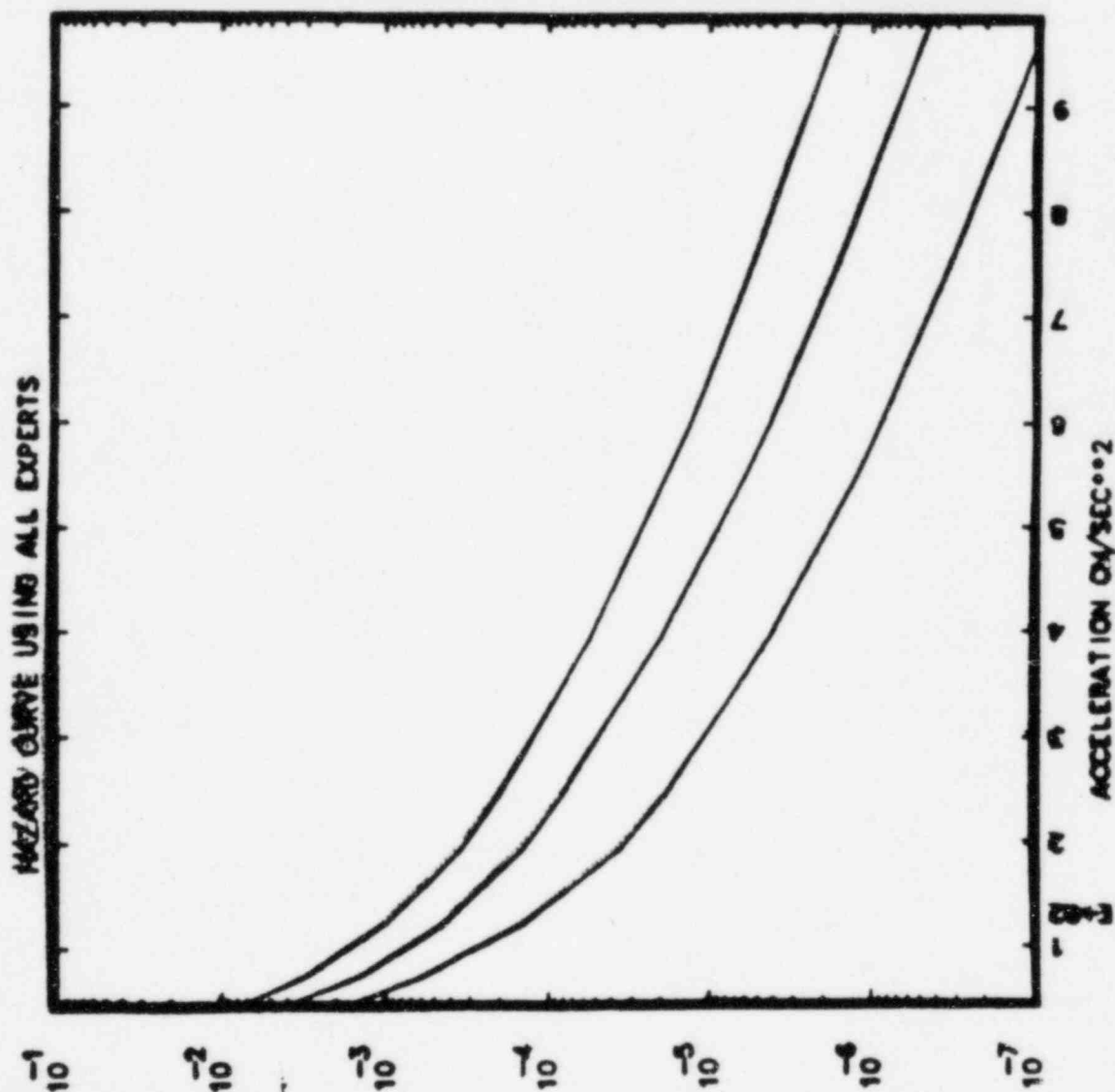
E. U. S. SEISMIC HAZARD CHARACTERIZATION INCLUDING SITE CORRECTION



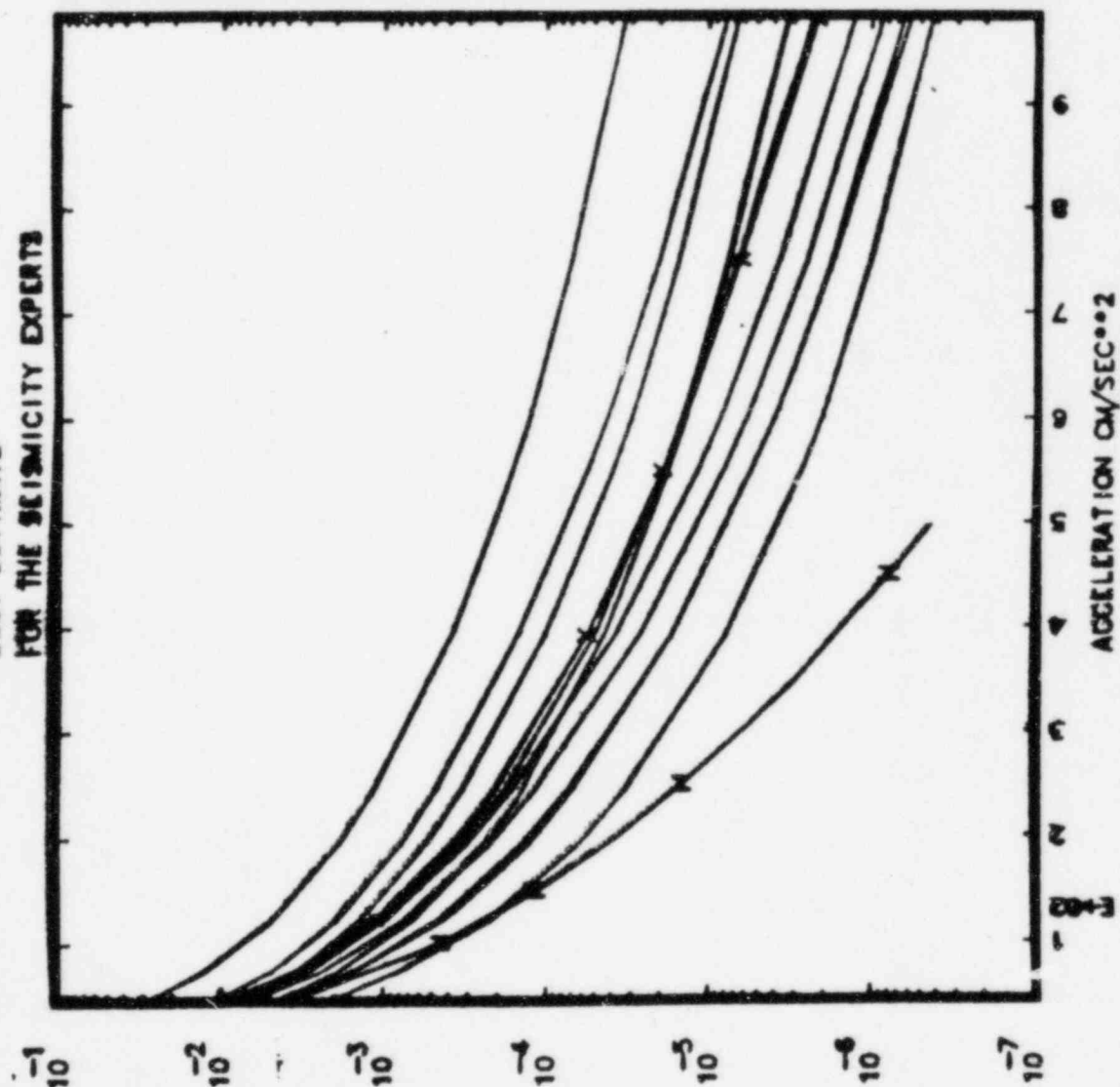
Key to Site name:

- 1 WATTS BAR
- 2 LIMERICK
- 3 MAINE YANKEE
- 4 MILLSTONE
- 5 VOGTLE
- 6 BRAIDWOOD
- 7 SHEARON HARRIS
- 8 WOLF CREEK
- 9 LA CROSSE
- 10 RIVER BEND

SENSITIVITY OF THE HAZARD TO THE B PARAMETER
 ALL OTHER PARAMETERS FIXED AT BEST ESTIMATE VALUES
 PERCENTILES = 15.0, 50.0 AND 85.0



BEST ESTIMATE FOR THE SEISMICITY EXPERTS



SENSITIVITY OF THE HAZARD TO THE MAX MAGNITUDE
 ALL OTHER PARAMETERS FIXED AT BEST ESTIMATE VALUES
 PERCENTILES = 18.0, 50.0 AND 85.0

