IMPLEMENTATION OF EARTHQUAKE EDUCATION IN THE UNITED STATES: AN OVERVIEW

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ABSTRACT

In May 1988, the National Center for Earthquake Engineering Research initiated an earthquake education project which focused on earthquake awareness and safety education in school programs for grades K-12. A primary focus of this program was surveying state education departments, individual school districts, and schools in the United States and the Territories to see who was offering earthquake education. A survey of the state education departments has been completed with fifty states and two Territories responding. Results of this survey will be presented, and difficulties with general implementation of earthquake and other hazard awareness curricula at the state education level will be highlighted. A need to find other dissemination and implementation mechanisms exists, especially in those states where the state education department cannot mandate curriculum.

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INTRODUCTION

The National Center for Earthquake Engineering Research initiated an earthquake education project in May, 1988. The program focused on earthquake awareness and safety education in school programs for grades K-12, with a special emphasis on grades K-6. The initial goals of this project were to determine what has been done elsewhere in the field, develop a package of materials with an appropriate amount of detail for students at varying intellectual and interest levels, and test those materials in an elementary level program.

The primary emphasis during the first six months of the project was on surveying state education departments, individual school districts, and schools in the United States and the Territories to see who was offering earthquake education. Earthquake education was defined as having a science and a safety component.

In addition to asking whether a state or particular school was offering earthquake education, the survey also asked whether the Federal Emergency Management Agency's (FEMA) Guidebook for Developing a School Earthquake Safety Program (December, 1985) was being used, what natural hazards curricula was being implemented, and if there was a school or classroom with a model natural hazards program.

STATE EDUCATION DEPARTMENT SURVEY

The first survey to be completed was directed to the state education departments. All fifty states and two Territories responded to the survey. Results of this survey indicated three states, Arkansas, California, and Kentucky, included earthquake education in their state education department guidelines (see Figure 1).

In Arkansas, there is a requirement for earthquake awareness and safety education in the state course outline starting in Junior High School. In addition, on May 26, 1989, the Arkansas Department of Education sent a memo to all superintendents noting the earthquake risk in Arkansas and stating, "...earthquake preparedness programs are essential and should be initiated, for those who have not done so, as soon as possible."[1] To assist with these programs, the following are offered: Guidebook for Developing a School Earthquake Safety Program (on request), lectures and video presentations for students in K-12, and optional scheduling of on-site inspections and recommendations for schools. The earthquake preparedness programs will be monitored by the K-12 area supervisors during annual visits.

In the California Science Framework Field Review Draft and Addendum (1984), there are several learner outcomes that deal with earthquake education. Information about earthquakes and plate tectonics is emphasized in the three themes of Energy, Evolution, and Patterns of Change, and integrated throughout various grades. Other materials used in the state include the

[1] Director's Memo No. 89-18, May 26, 1989, from Ruth S. Steele, Director, General Education Division, and Emma Boss, Associate Director, Instructional Services.

earthquake education materials developed by the California Earthquake Education Project (CALEEP); the "Hands-On Earthquake Learning Package" (HELP), from Environmental Volunteers; the Earthquake Awareness and Preparedness Project curriculum, which is a joint effort between the Audubon Nature Training Society and the Junior League of Oakland-East Bay; and "The Plate Tectonic Cycle," from Math/Science Nucleus. These materials address both earthquake science and preparedness.

In Kentucky, teachers are trained to use earthquake materials in elementary grades, and to integrate the materials in science and social studies. Materials from FEMA have been used for training sessions.

Information from the survey indicated that thirty-one states and the District of Columbia do not mandate earthquake awareness or safety education, although information about earthquakes might be included in general science or earth science (see Figure 2). For example, in Alabama, earthquakes are discussed in eighth grade earth science classes. Fifteen states could not mandate any curriculum and one other state could only give recommended guidelines to the school districts (see Figures 3 and 4).

The two territories that responded were American Samoa and Puerto Rico. American Samoa does not include earthquake education in their guidelines although earthquakes are discussed in Level 8 General Science. In addition, the government in American Samoa has a Disaster Planning Office and disseminates information and drill materials to the schools. In Puerto Rico, earthquake information is included in the ninth grade earth science curriculum. Earthquakes, plate tectonics theory, and landforms are discussed in a unit about subterranean processes.

Some state education departments provided additional information (see Figure 6). For example, six states, Hawaii, Illinois, Indiana, Missouri, South Dakota, and Utah, noted that either earthquake safety information is distributed to the schools and/or earthquakes are included in the disaster plans. Oregon includes earthquake safety in the school bus driver training program. Washington state indicated they had temporarily inherited a partially completed curriculum, "Project Quake," which is "...an interdisciplinary, supplementary environmental and safety program emphasizing the impact of earthquakes on the human physical, social, and emotional environments"[2] (p. 1). Currently, this exists as a preliminary curriculum which will be reviewed by the Pacific Science Center for a trainer's workshop along with other earthquake materials.

In Idaho, a project to develop seismic safety standards for Idaho schools has been completed and submitted to the Idaho State Board of Education. This study incorporated three aspects: the evaluation of the seismic hazard in the state from a geological viewpoint; seismic vulnerability of school buildings in the state; and the establishment of a school-based disaster preparedness program. The Idaho Department of Education has given school districts packets of pertinent information including the NSTA/FEMA curriculum, Earthquakes (FEMA 159).

[2] Project Quake is a K-6 curriculum initially undertaken by the School Earthquake Safety and Education Project (SESEP), under the direction of Linda Noson.

This survey provided some general information about what was occurring in some states, particularly highlighting the difficulties with general implementation of earthquake and other hazard awareness curricula at the state education level. There is a need to find other dissemination and implementation mechanisms, especially in those states where the state education department cannot mandate any curriculum.

INFORMATION FROM OTHER SOURCES

In over 30% of the states, the state education department does not mandate curricula. As a result, these departments do not keep data on what is occurring. For example, the Alaska Department of Education can only give minimal details of any earthquake education programs in the schools. They do not know the extent to which districts provide earthquake education. However, this information can be obtained from the Alaska Division of Emergency Services, which completed a survey of Alaskan School districts in Spring, 1988,[3] with 45 out of 55 districts providing information.

The Alaskan survey queried school districts on the following: emergency operations plans, the number of earthquake drills during a year, awareness programs requested, and new school construction in the next five years. The survey indicated that of the schools located in Seismic Zone Four, 25% had no earthquake drills; 25% had one earthquake drill per year; 33% had 2-4 earthquake drills per year; 8% had 6-12 earthquake drills a year; and 9% had "some" drills. Information such as this is invaluable to those actively working in earthquake education.

Because more information was needed than could be provided by state education departments, information about earthquake education programs was also collected from other sources such as FEMA; other preparedness organizations; Earthquake Information Centers; college and university faculty that have written articles about earth science and/or earthquake education programs or that have advised other programs; U.S. Geological Survey; Red Cross; professional teacher organizations such as the Earth Science Teachers Association; and the Krause Guide. Information from these sources is being compiled and analyzed.

Letters from state representatives of the National Earth Science Teachers Association provide additional information:

- From Florida, "Florida children do not need earthquake drills."
- From Iowa, "I must report that very little earthquake education is being taught in our school district. Even though we are fairly close to the New Madrid area, there is nothing in terms of hazard awareness mandated by our school district. Were there to be a damaging quake, I am sure few would have any idea how to react."

[3] "Earthquake/Tsunami Survey of Alaska School Districts," Spring 1988, Alaska Division of Emergency Services, Mike Webb, Earthquake Program Manager.

- From Ohio, "People in the state of Ohio do not seem to be worried about earthquakes because they do not seem to be important except as a news item. It happens other places but not here."

- From Pennsylvania, "...our District does not feel that earthquakes pose much of a danger to our students."

- From Texas, formerly from Missouri, "When I was at Bowling Green High School, they did not have earthquake drills. While I taught about earthquakes and reviewed what to do in case of an earthquake, the school did not think it was important enough to have a drill. One of the reasons was that it was not required by the state of Missouri...I have found that if the state does not require it, they will not have them...The same is true with the school district I am now in. It is located just north of Houston, Texas. They have had fire drills this fall only. I checked with the principal and he said, 'why?' when I asked about earthquake drills. In checking with the other science teachers, they teach earthquakes, but do not teach what to do if you are ever in one."

- From Wisconsin, "In the midwest we have little concern of earthquakes. The only natural hazard that we are concerned with is the tornado."

OTHER IMPLEMENTATION ISSUES

There are multiple issues involved in earthquake education, many of which hinder its effective implementation in school systems. Primary among these issues is raising the level of awareness of school systems to the need for earthquake education. Along with this, the focus of, and ultimately the place of, earthquake education in the curriculum becomes a major issue. The following are some questions that need to be addressed:

What constitutes earthquake education for children?
Where does earthquake and other natural hazard education fit into the curriculum?
Should earthquake education and preparedness information be presented in isolation or in the context of an established science program in the schools? Should it solely be a part of the school safety plan?
Should earthquake education be presented in areas with little seismic risk?
Should all materials be state specific?
Should school materials be used as bridges to the public?
Who should be responsible for earthquake awareness and safety education? At the state education department level? At the school district level? At the local school level?

There is a need for coordinated dissemination of information to minimize duplication of efforts and maximize distribution of usable information, as well as a forum to discuss pertinent issues. Available information needs to be specifically tailored for various populations and shared simultaneously with state education administrators, district superintendents, professional organizations, and teachers. In those states where the state education department cannot mandate

curricula, the emergency preparedness, professional, and national organizations can be used to spearhead earthquake education efforts.

CONCLUSION

Earthquakes have left schools damaged in the past and will probably do so in the future. Administrators, teachers, and staff need to be informed about earthquake hazards (see Figure 7) so they can be active agents in making the school safer. Earthquake education needs to be clearly defined and avenues for its implementation into the school system need to be aggressively pursued.

Figure 1

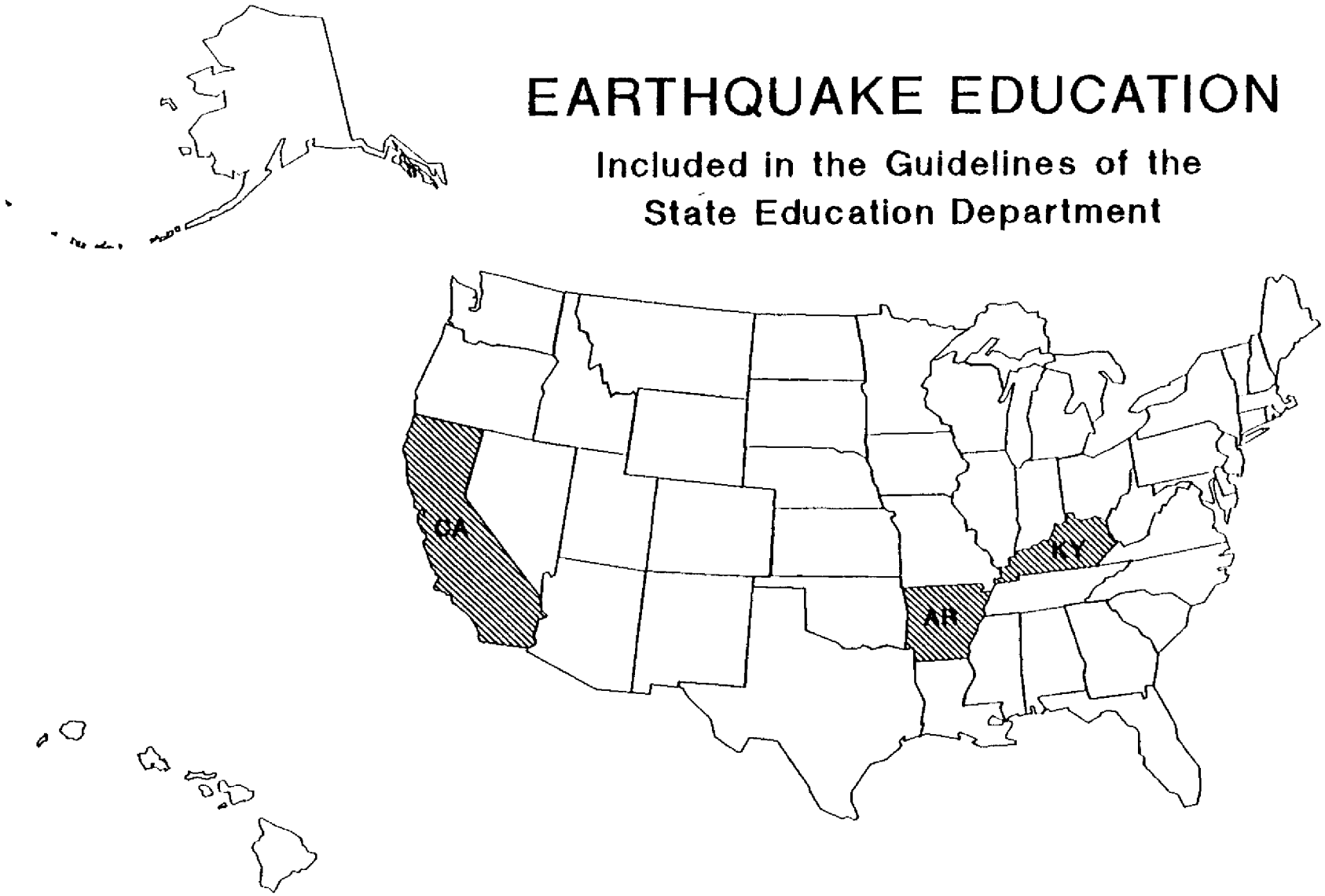
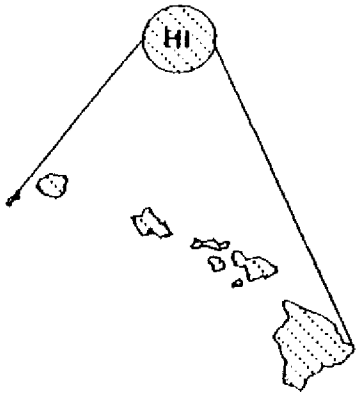
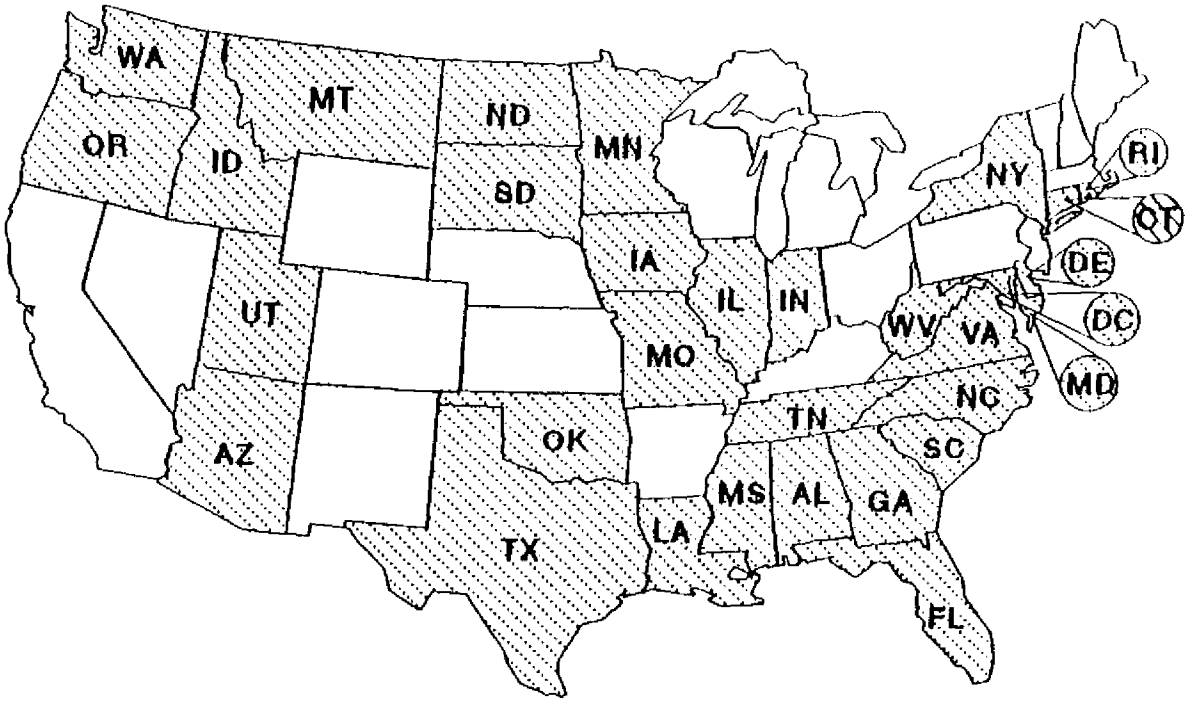

EARTHQUAKE EDUCATION
Included in the Guidelines of the
State Education Department
CA
KY
AR

Figure 2



EARTHQUAKE EDUCATION

No Earthquake Awareness or Safety Education Mandated by State Education Department



(Information about earthquakes may be included in general science or earth science)

Figure 3

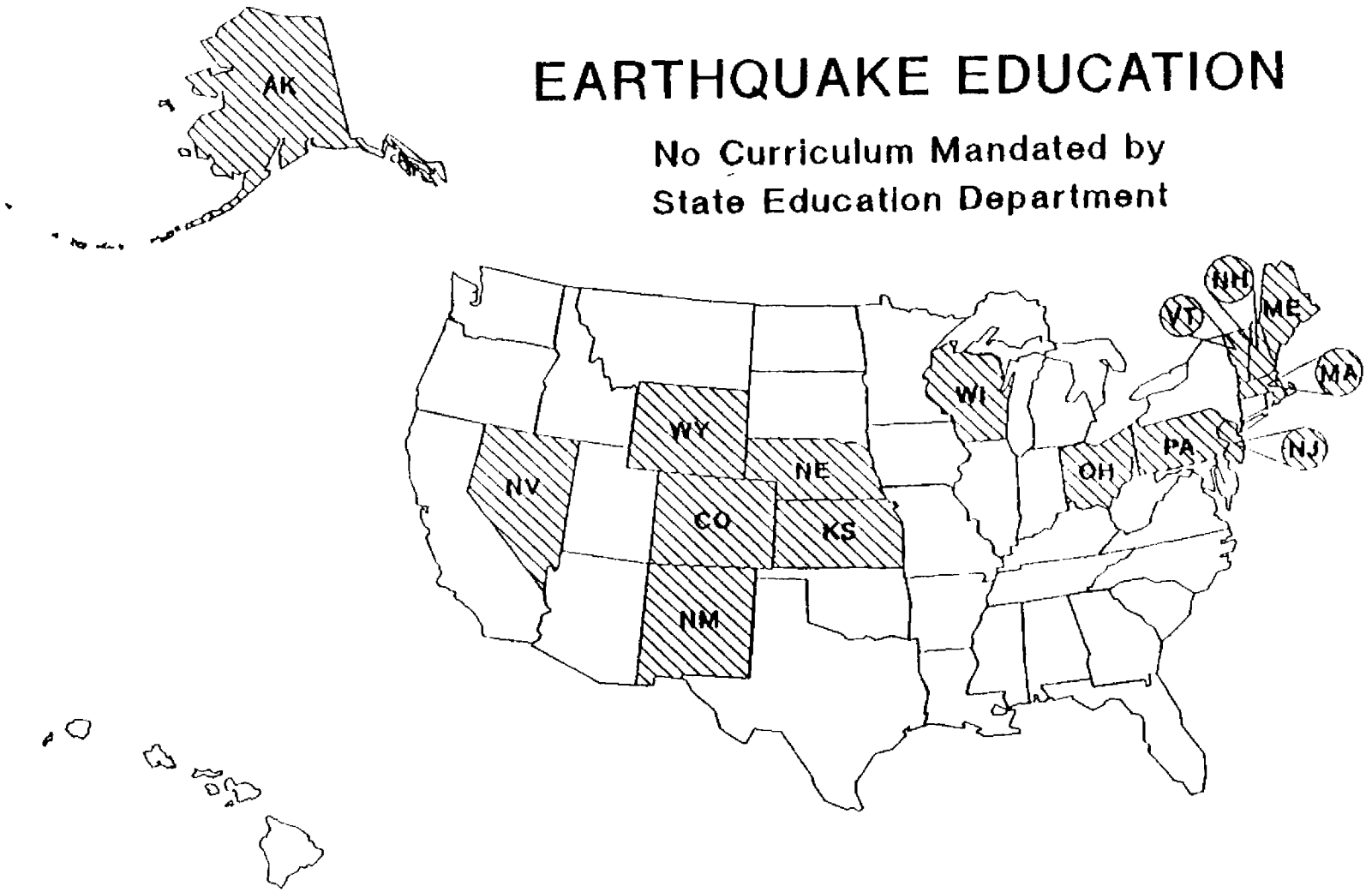

EARTHQUAKE EDUCATION
No Curriculum Mandated by
State Education Department
AK
NH
VT
ME
MA
WI
WY
NE
NV
CO
KS
PA
NJ
OH
NM

Figure 4

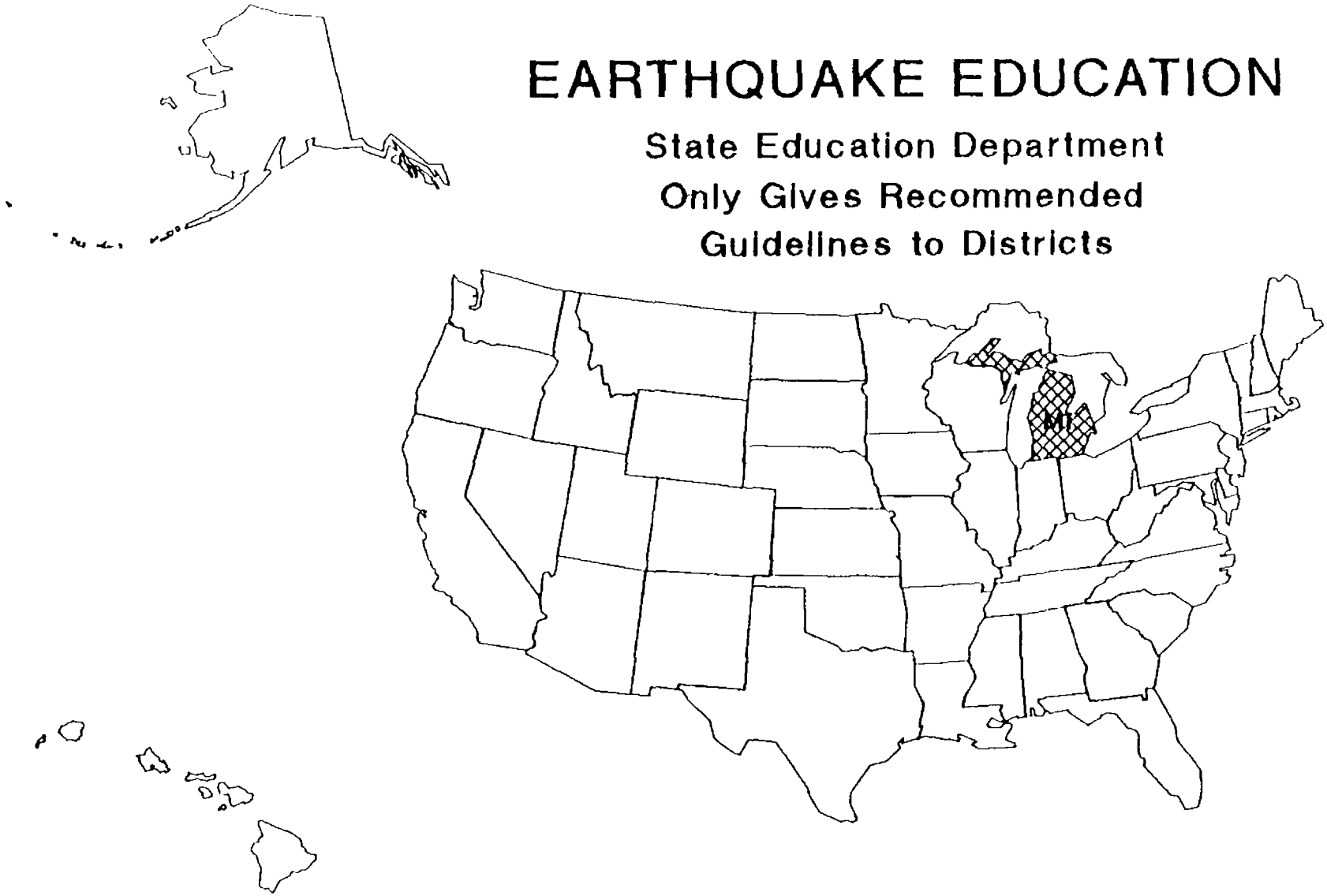

EARTHQUAKE EDUCATION
State Education Department
Only Gives Recommended
Guidelines to Districts

Figure 5

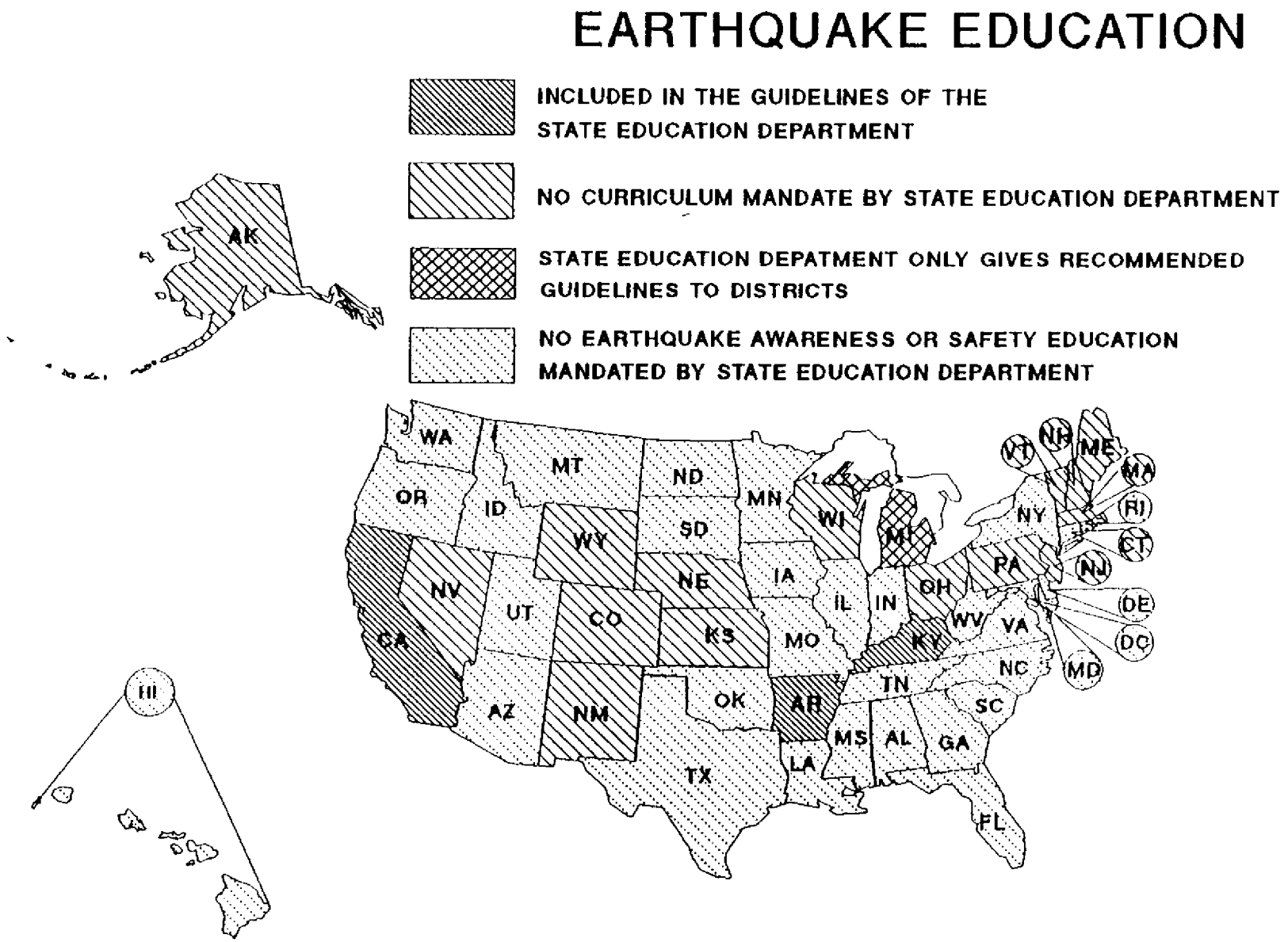

EARTHQUAKE EDUCATION
INCLUDED IN THE GUIDELINES OF THE STATE EDUCATION DEPARTMENT
NO CURRICULUM MANDATE BY STATE EDUCATION DEPARTMENT
STATE EDUCATION DEPATMENT ONLY GIVES RECOMMENDED GUIDELINES TO DISTRICTS
NO EARTHQUAKE AWARENESS OR SAFETY EDUCATION MANDATED BY STATE EDUCATION DEPARTMENT
AK
HI
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
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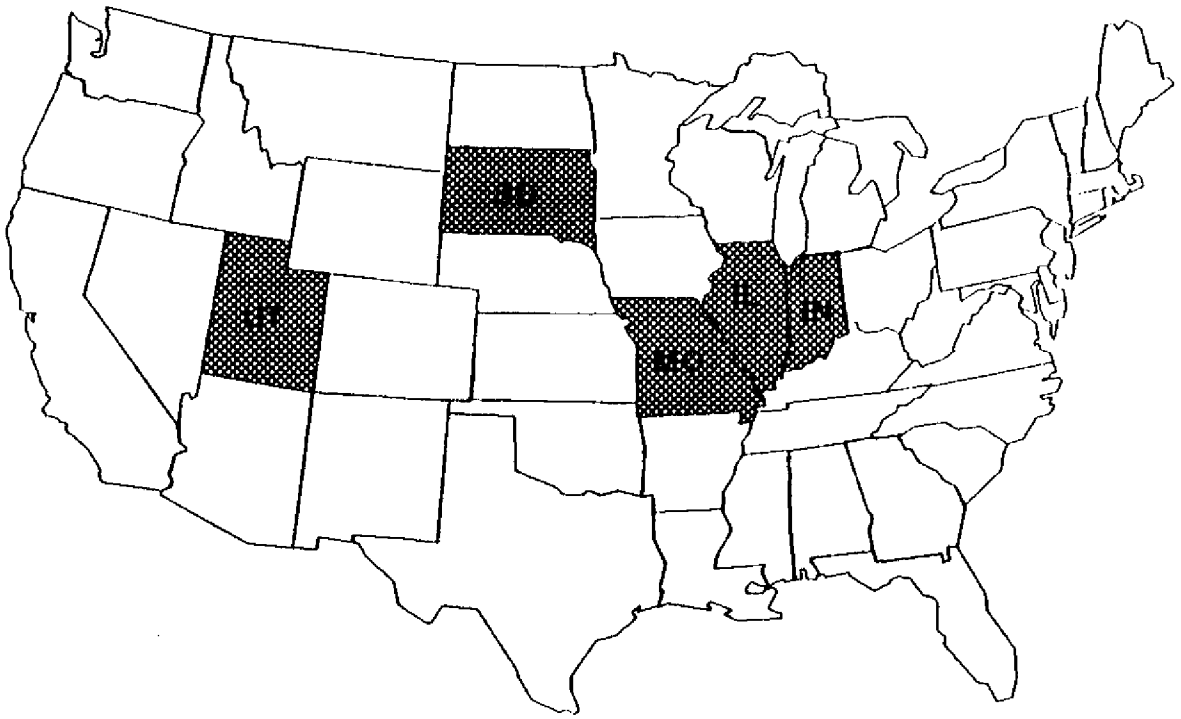
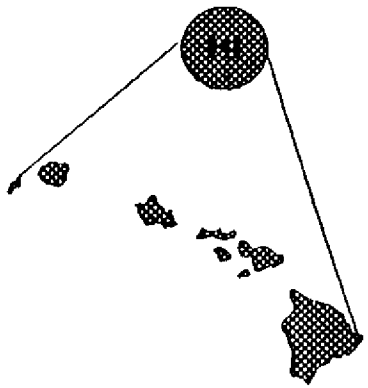
Figure 6

EARTHQUAKE EDUCATION

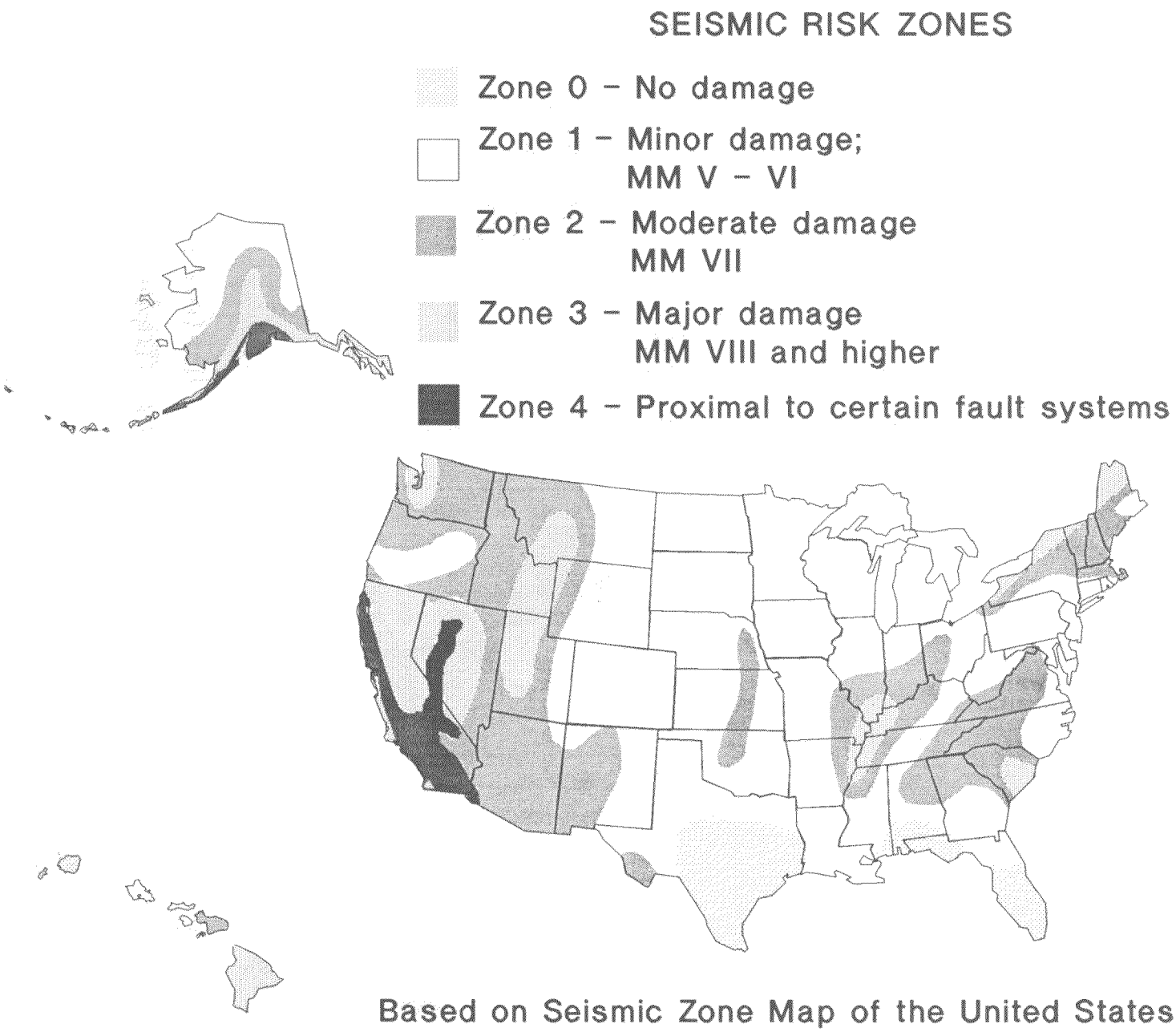
Earthquake Safety Information Distributed to Schools Earthquakes Included Disaster Plans *





* Information Volunteered by these States; this not meant to be an all inclusive list

Figure 7



Based on Seismic Zone Map of the United States,
Uniform Building Code, 1979

Table 1

RESPONSE TO EARTHQUAKE AND NATURAL HAZARDS CURRICULUM INQUIRY

LIST OF STATES	DATE RECEIVED	INFORMATION RECEIVED
Alabama	10/13/88	No earthquake education or safety instruction in schools. Do talk about earthquakes in earth science classes in 8th grade. Alabama has a course of study for districts to follow which delineates minimum standards only. Do provide tornado and hurricane safety information in the schools.
Alaska	9/14/88, 2/27/89	No curriculum mandated. Earthquake education is done by individual teachers in some districts, i.e. Anchorage. A seismograph was installed in Petersburg High School (southeastern Alaska) under a federal NEDA grant in 1976. This instrument continues to operate. It is maintained by students under the supervision of Mr. Paul Bowen, science teacher, and serviced by personnel from NOAA's Tsunami Warning Center at Palmer, Alaska.
American Samoa	3/21/89	No earthquake education. Do talk about earthquakes in Level 8 general science. American Samoa Government has a Disaster Planning Office and

LIST OF STATES	DATE RECEIVED	INFORMATION RECEIVED
American Samoa (Cont'd)	3/21/89	disseminates information and drill materials to the schools.
Arizona	10/27/88	No earthquake education. Information about earthquakes included in earth science but not safety aspects.
Arkansas	10/20/88	There is a requirement for earthquake awareness and safety education in the state course outline starting in Junior High School. EARTHQUAKE EDUCATION.
	5/26/89	Arkansas Department of Education sent a memo to all superintendents noting the earthquake risk in Arkansas and stating, "...earthquake preparedness programs are essential and should be initiated, for those who have not done so, as soon as possible."
California	9/27/88	Several earthquake programs in the state, i.e., CALEEP, sent Science Framework Addendum, 1984 which includes several learner outcomes dealing with earthquake education. Have used FEMA Guidebook. EARTHQUAKE EDUCATION.
Colorado	10/31/88	No curriculum mandated.

LIST OF STATES	DATE RECEIVED	INFORMATION RECEIVED
Connecticut	10/13/88	No earthquake education or safety in schools; no state earth science curriculum. Class on geology of region taught in Moodus.
Delaware	8/24/88	No earthquake education programs/natural hazard curricula in the schools.
Florida	5/20/88	"Minimum Student Performance Standards for Florida Schools," Enclosure 1 - Curriculum Frameworks -Grades 6-8 Florida Department of Education, Enclosure 2; no earthquake education.
Georgia	5/20/88	Process of being revised; no earthquake education.
	8/25/88	"K-8 Science Curriculum" approved; request a copy when it becomes available 10/88.
Guam		No response.
Hawaii	11/1/88	There is no earthquake education in the curriculum. Earthquakes, tsunami included in emergency preparedness plans for schools. Tsunami drills recommended once a year.
Idaho	4/20/88	"Secondary Earth Science Course of Study."

LIST OF STATES	DATE RECEIVED	INFORMATION RECEIVED
Idaho (Cont'd)	7/11/88	There is no formal mention about earthquake education in The State Science Curriculum Guide or in health and safety education. Earthquake education and safety is sometimes integrated into other subject matter areas, i.e. current events. Have no figures on how many teachers are teaching earthquake education to students in grades K-6.
Illinois	6/10/88	Information & instruction sheet for teachers and school administrators in the event of an earthquake, and a poster for the classroom bulletin board.
	6/17/88	"School Emergency Planning Guide," provided by The Illinois Emergency Services and Disaster Agency; includes chapters on earthquakes, tornadoes, severe thunderstorms, floods, blizzards. No earthquake education in curriculum.
Indiana	5/3/88	FEMA "Guidebook for Developing a School Earthquake Safety Program." No earthquake education in curriculum.
Iowa	4/20/88	"A Guide to Curriculum Development in Science;"

LIST OF STATES	DATE RECEIVED	INFORMATION RECEIVED
Iowa (Cont'd)	4/20/88	no earthquake education.
Kansas	4/28/88	No curriculum mandated.
Kentucky	5/11/88	Brochure - "Earthquakes;" also have manuals developed and printed by Federal Emergency Management Agency used for training sessions.
	6/28/88	In response to followup letter - Received FEMA's Emergency Management Instructions Draft IG 1.2, April 1981, K-3. Teachers in Kentucky are trained to use earthquake materials in elementary grades and integrate the materials in science and social studies. EARTHQUAKE EDUCATION.
Louisiana	9/13/88	No earthquake education in schools though earthquake information incorporated into earth science curriculum; earthquakes not included in school disaster plans.
Maine	5/12/88	No curriculum mandated.
Maryland	3/13/89	"Science - A Maryland Curricular Framework," earthquakes included as part of the regular earth science curriculum. No specific earthquake education.

LIST OF STATES	DATE RECEIVED	INFORMATION RECEIVED
Massachusetts	9/22/88	Department of Education does not have statutory authority to establish curriculum guidelines generally. Individual districts may offer training about earthquakes and natural hazards; but they don't collect that information.
Michigan	10/18/88	No earthquake education; no other natural hazards education. State education department gives recommended guidelines only to the district.
Minnesota	5/5/88	No curriculum distributed to schools - in process of developing a document which addresses this issue; no earthquake education.
Mississippi	5/16/88	"Curriculum Structure - Science" (Philosophy, Goals, Skills & Concepts); no earthquake education.
Missouri	5/9/88	"Administrative Guidelines for School Safety" and FEMA "Guidebook for Developing a School
	6/20/88	Earthquake Safety Program" FEMA K-6 Guidebook and lesson plans field tested by schools in Poplar Bluff and Excelsior Springs, Missouri. "Guidebook" has been distributed to over 500 locations in Missouri;

LIST OF STATES	DATE RECEIVED	INFORMATION RECEIVED
Missouri (Cont'd)	6/20/88	have received no feedback. State Emergency Management Agency developed a "Ready Teddy," talking bear designed for use in K-3, and also has "hands on" Earthquake learning package used in many schools. S.E.M.A. has, in conjunction with the University of Missouri, developed an Earthquake Education course for teachers. No earthquake education mandated in curriculum.
Montana	1/30/89	No earthquake education.
Nebraska	5/2/88	No curriculum mandated.
Nevada	4/28/88	No curriculum mandated.
New Hampshire	10/6/88	No state mandated curriculum. Earthquakes would be covered only as a part of regular science curriculum.
New Jersey	5/20/88	No curriculum mandated.
New Mexico	11/1/88	There is no earthquake education; no particular course is mandated by the state.
New York	5/5/88, 3/6/89	MS/JHS Syllabus, Block D - "The Earth's Changing Surface;" "Earth Science Syllabus;" "Earth Science - Supplement to to the Syllabus." Contains objectives related to earthquakes, eg. "The Earth's Changing

LIST OF STATES	DATE RECEIVED	INFORMATION RECEIVED
New York (Cont'd)	3/6/89	Surface" II.B.Constructional forces 1. Earth movements pg. 25-26 "Earth Science Syllabus" - Section B-1 "What are some properties of earthquake waves?" pg. 39-41 "Supplement to the syllabus" - LT1 2. "Earthquake Longterm Investigation" pg. 29-30. No earthquake education mandated in curriculum.
North Carolina	4/28/88	"Standard Course of Study and Introduction to Competency - Based Curriculum." No earthquake education mandated in curriculum.
North Dakota	11/1/88	There is no earthquake education. Tornadoes are included in the disaster plan.
Ohio	6/13/88	No curriculum mandated.
Oklahoma	10/6/88	Earthquake education not mandated; covered as part of regular science curriculum. Concentrate on tornado safety.
Oregon	9/13/88	No earthquake education in schools. Earthquakes are included as part of hazard training given to school bus drivers; windstorms and earthquakes are grouped together.
Pennsylvania	4/29/88	No curriculum mandated.
Puerto Rico	3/29/89	Earthquake instruction included in ninth grade earth science curriculum. In a unit about subterranean processes, the following are

LIST OF STATES	DATE RECEIVED	INFORMATION RECEIVED
Puerto Rico (Cont'd)	3/29/89	discussed: Earthquakes, Plate Tectonics Theory, and Land forms.
Rhode Island	8/19/88	No formal earthquake awareness activities designated by state education department; science teachers would talk about it as part of their curriculum when appropriate.
South Carolina	5/16/88	Course outline for Earth Science. Chapter outline on natural hazards and earthquakes, p.2. No earthquake education mandated in curriculum.
South Dakota	8/22/88	No formal earthquake instruction in schools. School disaster plans do include earthquake directions. Fire and tornado drills held by law.
Tennessee	9/2/88	"A Guide for Preparing a School Disaster Plan" which will be revised to include earthquakes. No earthquake education mandated in curriculum.
Texas	5/17/88, 3/24/89	"Science Framework, Kindergarten-Grade 12;" earthquake information is incorporated into the required eighth grade Earth Science course and the elective high school Geology course.

LIST OF STATES	DATE RECEIVED	INFORMATION RECEIVED
Utah	11/1/88	There is no earthquake education however, every school is required to have an emergency plan and this plan includes earthquakes.
Vermont	9/12/88	No state mandated curriculum; no earthquake education and earthquakes not included in disaster plans for schools.
Virgin Islands		No response.
Virginia	5/4/88, 2/13/89	No earthquake education mandated. State framework for science includes objectives related to Plate Tectonics theory (9th grade) and utilizing research skills to investigate scientific, environmental or individually selected problems (8th grade).
Washington	6/22/88	Have inherited partially completed "Project Quake" from Linda Noson; looking for money and legislative authority to complete it. (Legislature meets January, 1989; if it passes, soonest they'd start completion work would be July, 1989.) Currently, no earthquake education mandated in curriculum.
	7/89	Currently "Project Quake" exists as a preliminary curriculum and will be reviewed by the Pacific Science Center along with other earthquake materials to develop a trainer's workshop.

LIST OF STATES	DATE RECEIVED	INFORMATION RECEIVED
Washington, DC	8/30/88	Earthquake education not taught in elementary schools though earthquakes are included in a minor way in a science unit for grades 4-6. Earth science is an elective taught in senior high school and includes a unit on plate tectonics. A seismograph was installed by the students in basement of Ballou High School under leadership of Mr. John Thayer, (Physics Teacher).
West Virginia	5/16/88	Science program of study; no earthquake education.
Wisconsin	5/2/88	No curriculum mandated.
Wyoming	4/20/88	No curriculum mandated.