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UTILIZATION AND IMPACT OF EARTH SCIENCE INFORMATION AMONG LOCAL GOVERNMENTS AND BUSINESSES IN SOUTHERN CALIFORNIA

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CHAPTER 1
INTRODUCTION

Since the mid-1970's when earth scientists began to publicly discuss the possibility of forecasting damaging earthquakes, social scientists have studied public reactions to these announcements (cf, Turner et al. 1986). Even at that early time, earth scientists were concerned about the potential negative impacts their forecasts could have on social, economic, and political systems. One frequent question from the earth science community was: Would the announcement of an earthquake "prediction" have more severe consequences than would an earthquake itself? Local government leaders expressed concerns that, if their community were included in the area of predicted seismic activity, would their citizens temporarily or permanently leave the area? Would economic activities become depressed? Would citizens "panic?"

Social science research during this period generally allayed these concerns. Additionally, organizational mechanisms and procedures were developed between government agencies at the state and national levels and the scientific community to ensure that emergency management agencies and political officials could take appropriate actions, especially if forecasts were for "imminent" events (i.e., events within a few days).

More recent concerns of the earth science community focus on the need to communicate their probabilistic forecast information in forms understandable to local governmental officials, to the private economic sector, and to the public in general. The assumption underlying this concern is that a realistic understanding of regional earthquake hazards is necessary for state and local jurisdictions to take appropriate preparedness and mitigation actions. For example, as a result of
the findings of the ad hoc Working Group on California Earthquake Probabilities (1992) and USGS's resulting heightened estimates of the probability of a large magnitude earthquake in the San Francisco Bay Area, a joint effort was mounted in the Bay Area in the fall of 1990 to explain these revised probabilities to the public by inserting an elaborate 23-page section in Sunday newspapers (U. S. Geological Survey, 1990).

The Landers-Big Bear earthquakes of June 28, 1992 caused a similar scientific reassessment of the probability of a large magnitude earthquake in Southern California, resulting in an increased yearly probability of a M7 or larger earthquake throughout Southern California (ad hoc Working Group, 1992).

This project assesses the impact of recent earth science information on local governments and businesses in a four-county area of Southern California.¹ The focus of this research effort will be on the transfer of scientific earthquake hazard information to organizations (specifically local governments and businesses) and on the utilization of that information. We are especially interested in investigating the process whereby this information gets to decisionmakers in these organizations. We feel that this investigation is timely, given the dissemination of the ad hoc Working Group's Phase I report and the media attention it garnered and the anticipated dissemination of the ad hoc Working Group's Phase II report².

¹ Originally, it was proposed that this project would study a five-county area which included Los Angeles County. However, due to the 1994 Northridge Earthquake, Los Angeles County was dropped from the study because the earthquake's major effect over a wide part of the urban area made that county substantially different from other Southern California counties, stimulating a great deal of new mitigation and preparedness actions based on new earth science information.

² Despite plans to the contrary, the Phase II report was not made public during the data collection phase of this project; therefore, its possible effects are not reflected in this report.
Evaluation of NEHRP-Generated Information

Since the enactment of the National Earthquake Hazards Reduction Act in 1977, a wealth of research information characterizing and assessing earthquake hazards and their consequences in the United States has been produced and disseminated. However, there have been very few efforts undertaken to evaluate the effectiveness of transferring or utilizing this information. In this section, a brief overview of these evaluation studies will be presented\(^3\), with a special focus on those efforts that evaluated the transmission, understandability, and use of earthquake prediction\(^4\) information.

Transmission of Scientific Information

In one of the first formal evaluations of the extent to which earthquake hazard research findings actually got transferred into practice, Robert K. Yin and Gwendolyn Moore undertook a series of case studies on specific research projects to better understand the process by which earthquake research products are used in order to improve the usefulness of such efforts for practitioners. The research outcomes they investigated included: the Association of Bay Area Governments' study on local governments' liabilities for injuries or losses due to earthquakes (Moore and Yin, 1983a); a cost-effective method to evaluate and retrofit unreinforced masonry

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\(^3\) A number of evaluations of other aspects of earthquake hazard reduction efforts and programs have been undertaken, but those studies are not included in this review. Only research focusing on the transmission and utilization of scientific information to users is discussed here, because of its relevance for the proposed study.

\(^4\) The term, "prediction," is being used here generically to connote the popular understanding of earthquake hazard information in the mid-1970's. Today, the public is becoming more aware of the terms "forecasts" or "heightened probability" as they relate to the likelihood of an earthquake's occurrence in a regional context.
buildings (Moore and Yin, 1983b); a National Academy of Sciences report synthesizing knowledge related to the social and economic implications of earthquake predictions (Moore and Yin, 1983c); a research conclusion that the consumer is a source of market failure in the earthquake insurance market (Yin and Moore, 1984); a "dynamic assessment method" used to identify soils that are likely to liquefy during earthquakes (Moore and Yin, 1984a); and the development of synthetic accelerograms to assist design professionals when actual ground motion data are unavailable (Moore and Yin, 1984b). Although the extent of the usefulness of each of these innovations varied, Yin and Moore concluded that utilization of research results can be enhanced by a variety of factors, including: the active participation of the researchers with potential users, both during and after the conclusion of the research effort itself; the inclusion of representatives of the anticipated user groups on the project's advisory committee; the active dissemination of products or results in interactive settings between the researchers and users; and a research effort that was problem-focused for specific users.

In a follow-up study, Yin and Andranovich (1987) examined the role of professional associations in facilitating the use of 14 research innovations for the associations' members. Four of the associations studied are central to the dissemination of earthquake-related information to different user communities: the American Planning Association; the American Society of Civil Engineers; the Earthquake Engineering Research Institute; and the Structural Engineers Association of Southern California. They concluded that neither research-development (R&D) funding agencies nor professional associations should view the utilization role of associations as straightforward. Any simplistic model that merely connects knowledge producers and knowledge users with respect to a specific innovation is not likely to be successful. Instead, a model that
incorporates multiple organizations using several channels to transmit information to users is more likely to make potential users aware of the research innovations.

In 1984, Nigg conducted an evaluation of an educational program developed at the Tennessee Earthquake Information Center (now known as the Center for Earthquake Research and Information) at Memphis State University. The purpose of that train-the-trainer program was to prepare volunteers to present earthquake information to citizens' groups in the community, an objective that was intended to expand the resources available to the Center for meeting the public's demands for earthquake information. The purpose of the evaluation was to determine whether the volunteers had been adequately prepared and had adequate educational resources for these speaking engagements. It was concluded that although the volunteers were enthusiastic and believed that the training greatly improved their ability to present information to the public, they clearly needed more than one training session. Depending on the focus of the training session, volunteers needed additional instruction to clarify or correct their understandings of scientific information on earthquake-generating mechanisms and the location of Central U.S. earthquake faults. This finding indicates that even when members of the public are interested in earth science information and have been given a well-developed, "translated" scientific program, they needed repeated exposure to this information in order to understand it fully.

In related research, Nigg and her colleagues (1989; 1992a; 1992b) evaluated the dissemination and utilization of the NEHRP Recommended Provisions by the Building Seismic Safety Council (BSSC). The evaluation was undertaken for the Federal Emergency Management Agency to determine: (1) the understandability of the documents, developed by BSSC and containing the earthquake hazard information and NEHRP Recommended Provisions for new
non-federal buildings, for their target audiences; and (2) whether the disseminated materials motivated the utilization of the Recommended Provisions by targeted audiences. With respect to format and understandability, recipients who had reviewed the documents they received gave them exceedingly high, positive evaluations. While overall utilization of the Recommended Provisions was relatively low, targeted engineers in high-risk metropolitan areas (outside of California) did report strong beliefs that the Provisions could substantially reduce earthquake losses in their communities if they were implemented. However, the dissemination strategy selected by BSSC to get the documents into the hands of their intended users did not meet with much success, especially for populations of facility managers for whom specific documents were developed (e.g., those who managed hotels or motels, primary or secondary schools, or health care facilities). Sending mass mailings to members of pertinent professional associations did not result in the documents being read or remembered. Recommendations were made on how to improve the dissemination process in order to enhance the likelihood of utilization.

Transmission and Understanding of Earthquake Prediction Information

Over the past two decades, there has been a marked increase in efforts to disseminate earthquake prediction information in both the U. S. and other countries. These predictions have generally fallen into four (not necessarily mutually exclusive) categories: predictions based on analyses of newly-collected data or reassessments of existing data; predictions stemming from

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5 Although we are aware that scientific predictions have been made in many other countries, notably China and Japan, that the societal response to many of these predictions have been studied by social scientists (see, for example, Stallings, 1982, Hirose, 1985, Yong, 1988), and that prediction efforts of various kinds have been made throughout history, for purposes of brevity we will confine ourselves here to discussing research on recent earthquake predictions in this country.
concern about geologic anomalies; predictions issued in the context of on-going seismic activity; and pseudo-scientific or nonscientific predictions. This stepped-up forecasting activity has been accompanied by parallel efforts on the part of social scientists to study the societal impacts of these different forms of earthquake prediction.

The distinctions made here with respect to different types of earthquake predictions are not trivial; the fact that prediction efforts take various forms and occur in different contexts is important to take into account when assessing their societal impacts. For example, earthquake forecasts issued during times of little or no seismic activity will likely generate different patterns of attention and response than those issued in the aftermath of a dramatic or damaging seismic event. This is one reason why it is important to conduct social science research on the entire range of prediction activities—including the revised probabilities that are the topic of the proposed study. Because it is not necessary to report exhaustively on all the relevant social science research literature here, key studies on each of the different prediction contexts will be briefly discussed below to illustrate the major social science research approaches taken in this area. (For a thorough and up-to-date review on the social science literature on earthquake prediction, see Mileti and Fitzpatrick, 1993.)

**New Scientific Data**

The Parkfield "Prediction Experiment." Many earthquake predictions follow from systematic data collection and analysis as well as from scientific discoveries. Initiated in 1984 when two scientists submitted data to the National Earthquake Prediction Evaluation Council (NEPEC), the Parkfield earthquake prediction experiment involved an anticipated Richter
magnitude 5.0-6.0 earthquake occurring on the Parkfield segment of the San Andreas fault between 1985 and 1993 (Bakun and Lindh, 1985). As part of a study to assess the impact of the experiment, Mileti and his colleagues investigated citizens' understanding of a brochure sent to 122,000 households in 1988 that was intended to educate residents about the predicted earthquake and how to prepare for it. The brochure, which was sent out by California's Office of Emergency Services, provided information on earthquake hazards, the prediction, a possible short-term warning, what the public could do to get ready, and where they could get additional information.

Perhaps the most important finding from the research conducted by Mileti and his associates is that the risk communication effort that accompanied the Parkfield prediction (which involved both the brochure and interpersonal communication) was effective. Based on their research, Mileti and his colleagues concluded that "The public can be convinced to perceive environmental hazards more accurately and to engage in protective behavior because of risk information" (Mileti, Fitzpatrick and Farhar, 1992: 38). The public education effort associated with the Parkfield prediction experiment worked because it involved multiple messages, emanating from multiple sources and delivered through multiple channels. The interpersonal communication processes that accompanied the educational effort likely reinforced citizens' risk perceptions and the need to consider taking preparedness and mitigation actions (Mileti and Fitzpatrick, 1992; for additional social science findings concerning the Parkfield experiment, see Mileti, Fitzpatrick, and Farhar, 1990 and Mileti and Fitzpatrick, 1993.)
Geologic Anomalies and Other Precursory Phenomena

The "Palmdale Bulge." Various precursory phenomena and anomalies constitute another source of earthquake prediction activity. In an effort to answer early questions concerning how Los Angeles County residents were understanding earthquake prediction information, research was undertaken by Ralph Turner and his colleagues in 1976. Specifically, they were interested in investigating how people understood the scientific information on the Southern California Uplift (the "Palmdale bulge") and the research hypothesis being tested by James Whitcomb (then at Caltech). They also were interested in the effects of the media on framing people's understanding of both scientific and pseudo-scientific information (such as the earthquake prediction by Henry Minturn), on people's beliefs about the likelihood of an earthquake, their perceptions that they and their communities were at risk, their beliefs in science's ability to develop earthquake prediction capabilities, their tolerance of low probability estimates of large magnitude earthquakes, and what people thought could and should be done to lessen earthquake risks.

Several of their findings are germane for the purposes of this proposal (Turner et al, 1986). First, few people remember the specifics of any earthquake prediction announcement. However, when those announcements were believed to come from a scientific source, they were given greater credibility and taken more seriously. Second, the greater the amount of media attention focused on the topic of earthquake prediction and hazards, the more people were aware of general earthquake hazard information and the more concerned they were that a damaging earthquake could take place, effecting their communities. Third, even at that early stage of the development of the science of earthquake forecasting, the public expressed great confidence that
scientists would develop such capabilities. Fourth, contrary to some of the popular beliefs at that
time, people wanted to hear more information about earthquake predictions coming from the
scientific community, even if such forecasts had very low probabilities attached to them.

Predictions Issued in the Context of On-going Seismic Activity

Unlike predictions issued in the contexts discussed above, predictions that accompany or
follow from actual seismic events may under some circumstances be more likely to gain the
attention of their target audience. This is particularly true if the seismic event that triggers the
issuance of the prediction is a major damaging earthquake like Loma Prieta. For purposes of
illustration, we divide these types of advisories into three categories: those involving presumed
precursor earthquakes; aftershock warnings; and revised probabilities, which are the topic of this
study.

Precursor Earthquakes. Occasionally predictions are issued because increases in seismic
activity indicate to scientists that a larger event may be immanent. One such prediction was made
as a result of a series of small earthquakes that occurred on the Rose Canyon Fault in June, 1985.
On the basis of these smaller events, USGS seismologists decided that there was a slight increase
in the probability of a damaging earthquake in the San Diego area. Unfortunately, San Diego
County initially heard of the prediction through informal rather than official channels, and a
number of problems ensued. At that time the San Diego prediction was made, none of the
jurisdictions in the area had plans in place for dealing with a short-term prediction like the one
that had been issued. Local officials concluded on the basis of that experience that prediction
response plans would have helped reduce their own confusion about what to do in light of the
prediction as well as that of the public (Southern California Earthquake Preparedness Project, 1985; Mileti and Fitzpatrick, 1993).

**Aftershock Warnings.** Another type of earthquake prediction activity involves the dissemination of aftershock warnings following a significant seismic event. Following the 1989 Loma Prieta earthquake, numerous aftershocks occurred and several aftershock warnings were issued to the public. Mileti and his associates studied how residents of San Francisco and Santa Cruz Counties responded to these aftershock warnings. They found that most people were aware of the aftershock warnings, particularly in Santa Cruz County, and a large proportion of the sample of residents they surveyed (66% in San Francisco County and 75% in Santa Cruz County) believed that damaging aftershock warnings would occur. A substantial number of those surveyed took additional preparedness measures in anticipation of aftershocks. However, the people most likely to pay attention to and act on aftershock warnings were those who had experienced damage in the mainshock and who subsequently got involved in the community emergency response. On the basis of their research, Mileti and O'Brien (1992: 53) concluded that:

Those who experience little or no loss in the impact of a disaster may be prone to a "normalization bias" when interpreting post-impact warnings for subsequent risk: "the first impact did not effect me negatively, therefore subsequent impacts will also avoid me."

Such a conclusion would, of course, be unwarranted. Nevertheless, if this is indeed what members of the public conclude when they are exposed to the information contained in aftershock warnings, we need to learn more about how to effectively counter the "normalization bias."\(^{6}\)

**Revised Probabilities Following Major Seismic Events.** It is also becoming increasingly common for scientists to reassess their analyses and projections concerning the earthquake hazard in a region following the occurrence of a major earthquake, and then to issue updated forecasts based on these new studies to local jurisdictions and the public. One significant effort of this type involved the revision of Bay Area earthquake probabilities following the 1989 Loma Prieta earthquake and the subsequent large-scale effort to inform Bay Area residents about these revised probabilities and encourage them to increase their preparedness. The revised probabilities developed and issued following the 1992 Landers-Big Bear earthquakes are another important example of this kind of prediction/education effort.

**Pseudo-scientific and Nonscientific Predictions**

**The 1990 Iben Browning "Projection."** Finally, it is important to understand how the public and key stakeholder groups such as local government and corporate officials respond to earthquake predictions that are not scientifically credible and not sanctioned by legitimate sources. Such predictions are quite common and have a variety of unfortunate societal impacts. For example, they confuse the public if they are widely disseminated; they create additional burdens

\(^{6}\)As we indicate in a later discussion, the "normalization bias" may also be at work among local officials, not just among community residents. That is, those officials whose jurisdictions have not experienced damage in a mainshock may also find subsequent risk communications less credible, and may be less willing to take protective measures, than those whose jurisdictions did suffer losses. This is a topic that the proposed research addresses.
for emergency managers, government officials in general, and legitimate scientific researchers who have to deal with this confusion; and they may damage the credibility of the science of earthquake prediction in the eyes of the public.

Research on the 1990 Iben Browning earthquake "projection" highlights the importance of understanding how both the public and community decisionmakers perceive and use scientific information about the earthquake hazard. During the months prior to December 3, the date on which the "projection" focused, many scientists and emergency management professionals tried very hard to communicate accurate, scientifically valid information about the hazard in the New Madrid area. However, a number of studies suggest that a significant segment of the public believed the "projection" and considered Browning a credible source of hazard information. More importantly, both media reports and systematic research suggest that many public officials in the New Madrid area also took Browning's forecast seriously and acted accordingly, contributing to the public's confusion and worry. Business owners in the New Madrid area were also concerned about the "projection" and unclear about what to do about it. The Browning case demonstrates that many local government and business officials are not clear on what types of earthquake hazard information exist for their jurisdictions and that they have difficulty distinguishing between information sources that are scientifically credible and those that are not. (For more information on social science research on the Browning prediction, see Edwards, 1991; Dearing and Kazmierczak, 1991; and Tierney, 1994).

There may be a tendency to dismiss the Browning case as the kind of episode that can only occur in a part of the country that is relatively unfamiliar with earthquake hazards and uncertain about which sources of earthquake information are scientifically credible and legitimate.
However, DRC's recent field work in the Bay Area suggests that even in California there are still many local decisionmakers whose views of the earthquake hazard are not based on sound scientific information. For example, in 1992 our interviewers were told by a high-ranking official in one Bay Area community near the San Andreas fault that the community did not face a significant earthquake hazard, and thus did not need to do anything more to improve its hazard reduction programs. The official based this assessment on the fact that the Loma Prieta earthquake had not caused significant damage there. Such comments suggest that earth science informational materials may still not be reaching everyone that needs them, even in high-risk areas that have been targeted for special emphasis.

**Objectives of the Research**

This study builds upon these earlier research efforts by focusing on (1) the ways in which various types of earth science data and reports on earthquake hazards in Southern California are being used in seismic risk management, emergency preparedness, and mitigation decisionmaking in local jurisdictions and corporations; (2) the sources local and corporate decisionmakers use in obtaining information on the earthquake hazard; (3) the role scientific data on earthquake hazards plays in the decisionmaking process; (4) the factors that facilitate and impede the use of earth science information in decisionmaking; and (5) the informational needs of these local and corporate officials.

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7This finding suggests that the "normalization bias" uncovered in the aftershock warning study by Mileti and O'Brien (1992) may also be at work as officials try to assess new information they receive concerning the earthquake hazard. Surviving one seismic event without sustaining major damage may cause these officials to discount the hazard.
The following research issue areas and questions are addressed in this study:

1. How knowledgeable are local government and corporate officials about earth science research on the earthquake hazard and earthquake probabilities? Are they familiar with the contents of recent reports suggesting that earlier projections may have underestimated the probability of a damaging earthquake? How much do they know about earthquake hazards in their jurisdictions?

2. Through what sources do local and corporate officials obtain information on earthquake hazards? Which organizations, associations, and professions do they consider important providers of earthquake information? How aware are they of the services and information organizations like the USGS, SCEPP, and SCEC can provide? If they use materials produced by these organizations, how do they use them, and how do they rate their usefulness?

3. How important are these various informational resources in influencing decisions that are made by local governments and corporations? Are they taken into account in strategic plans and decisions about the allocation of resources, and if so, how are they used? If the informational material that is available doesn't have an impact, why not? In what ways can earth science informational resources be made more useful and effective for risk managers, local executive officers, and emergency management and corporate officials? What channels of communication might be more effective in getting earth science information to these decisionmakers?

By focusing on individuals who hold positions of responsibility in local government and businesses in Southern California, the study focuses on whether information on seismic hazards is
reaching individuals who are in positions to influence overall policy and planning in their cities, counties, and companies. An implicit assumption of this approach is that the information that is produced is unlikely to have an impact on decisions unless it reaches persons who play key decisionmaking roles, at least in some form.

This study can provide several kinds of information for producers and disseminators of earth science information. It can, for example, indicate the extent to which information transfer activities are having an impact on the upper levels of local government and the business community. It can provide information on the sources decisionmakers typically use in making judgments about earthquake hazards. It can provide information on what types of materials most influence local decisionmakers as well as on how to increase the use of earth science informational sources.

Format of the Report

This report deals primarily with the results of the study of city and county governments in Southern California and their awareness and utilization of earth science information. This study was carried out by the Disaster Research Center at the University of Delaware. The parallel study of 14 large business firms in the same four Southern California counties, conducted and prepared by the Natural Hazards Research and Applications Information Center at the University of Colorado, Boulder is contained in Appendix E.
CHAPTER 2
RESEARCH METHODOLOGY

To assess the extent to which earth science information is being used by local
governments, officials in four Southern California counties and their county seats were
interviewed about their awareness of, familiarity with, and utilization of documents with earth
science information that is specific to their local jurisdictions. These counties were selected
because they all contain significant seismic hazards but have not experienced a major metropolitan
earthquake in recent years. All of these counties have been identified over the years with
earthquake hazards on major and minor fault systems and have been advised by the earth science
community to expect a major earthquake in the near future (at least within 30 years). The county
seats were also the largest cities in each county, providing a context and, ostensibly, the capability
to address and manage a range of earthquake risks within the community.

This chapter presents the process by which city and county respondents were selected for
inclusion in the study, as well as the process by which lists of relevant earth science products were
identified for the study's cities and counties. These lists of products were a primary focus of the
interviews.

Selection of Interviewees

The first task of this study was to develop a list of interviewees in each city and county
who were the likely users or consumers of earth science information for their jurisdictions. That
is, we needed to identify key personnel in local government who are likely to use earth science
information for general seismic safety planning, emergency management, and risk management activities. State hazard mandates, such as the Alquist-Priolo Earthquake Fault Zones Act, often provide information on who is responsible for implementation at the local level. These mandates as well as research methodologies of similar past research (see Spangle and Associates, 1993) were consulted to produce a list of seven functional positions, listed in Table 2A.

TABLE 2A. FUNCTIONAL POSITIONS WITHIN CITY AND COUNTY GOVERNMENTS SELECTED FOR INCLUSION IN THE RESEARCH

<table>
<thead>
<tr>
<th>POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chief Executive (Administrative) Officer/ City or County Manager</td>
</tr>
<tr>
<td>Head of Building Department</td>
</tr>
<tr>
<td>Head of Planning Department</td>
</tr>
<tr>
<td>Head of Public Works</td>
</tr>
<tr>
<td>Emergency Manager</td>
</tr>
<tr>
<td>Risk Manager (or functional equivalent)</td>
</tr>
<tr>
<td>Staff Geologist (if existing)</td>
</tr>
</tbody>
</table>

The next step was to identify the individuals who held each of these functional positions in each city and county in the study. However, it was assumed that not all of these individuals would be the appropriate personnel to interview. Instead, these individuals provided a starting point for identifying the users of earth science information within each local jurisdiction. In
February 1995, phone calls were made to the personnel departments of each city and county to identify the potential respondents. One obvious problem encountered in this process was the variation in organizations and administrative hierarchy across the jurisdictions. Not every city or county is organized in the same way or uses the same titles for comparable functional positions. Regardless, Center staff were able to ascertain the names, addresses, and telephone numbers of the individuals occupying the functional or similar positions initially selected for study inclusion.

In early March 1995, each of the city and county officials identified were mailed a letter providing information on the research and a request for their participation in the study. (Appendix A contains a sample of this letter.) The potential respondents were informed that research associates of the Center would be calling in the next two weeks to schedule appointments. The possible respondents were also asked to inform Center staff at that time if there were informants in their offices that were better qualified to participate in the interviews. In only a small number of cases were Center staff referred to other potential informants who were subsequently contacted. In all, 45 interviews were scheduled.

Immediately after scheduling the appointments, confirmation letters were sent to the respondents along with a list of earth science products covering their jurisdiction. Respondents were asked to review these lists prior to the interview. (Development of these lists is discussed below.) Table 2B provides a breakdown of the number of officials and agencies interviewed in the cities and counties in the study.
### TABLE 2B. NUMBER OF OFFICIALS AND AGENCIES INTERVIEWED BY CITY AND COUNTY

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>NUMBER OF AGENCIES INTERVIEWED</th>
<th>TOTAL NUMBER OF INTERVIEWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>County A</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>City A</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>County B</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>City B</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>County C</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>City C</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>County D</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>City D</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>35</strong></td>
<td><strong>45</strong></td>
</tr>
</tbody>
</table>

Overall, 45 officials were interviewed in 35 agencies during the last 10 days in March, 1995. The total number of interviews conducted does not reflect the number of agencies contacted since many respondents were located within the same agencies or departments. For example, the Public Works Director and Director of Planning and Zoning for County C are both located in the Environmental Management Agency. The large differential between agencies contacted and interviews conducted in County C is also due to a large reorganization that was taking place in that jurisdiction. In County B, the Director of Planning, the County Geologist, and the Director of Building and Safety are all located in the Transportation and Land Management Agency. While most cities and counties have personnel that correspond closely to the initial functional positions selected for the research, counties A and B were the only jurisdictions that had staff geologists.
Identification of Earth Science Products

A primary purpose of these interviews was to ascertain the extent to which local officials are using earth science products and how useful those products are for local decision-making concerning seismic hazard reduction. For purposes of this report, "earth science products" refers to a variety of materials that discuss, display, or interpret seismic hazard information, including scientific reports, USGS open-file reports, maps, reports that used scientific findings, planning scenarios, and other seismic hazard-identification publications. These products could have been in scientific journals, federal or state publications or map series, or publications produced by an agency for a specific purpose. Occasionally, they could include publications of geological societies or university research centers when the materials were found to be widely cited.

In order to determine what products could be of use to local decision makers, lists of earth science products were produced for each county and its county seat. Since no publications or products were found to identify specific seismic hazards within a city's jurisdictional boundaries, no city-specific lists were produced.

A number of information sources were used to generate the product lists. In January 1995, a reconnaissance trip was made to Los Angeles and Sacramento, California to meet with state and federal agencies that have responsibility for producing and disseminating earth science information. Agencies contacted included the United States Geological Survey (USGS); California Department of Conservation, Division of Mines and Geology (CDMG); California Seismic Safety Commission; and the California Department of Water Resources. Interviews were conducted with key personnel in these agencies to determine what types of earth science
information they were receiving, producing, and disseminating in order to determine what materials should be identified as earth science products.

Informants for the USGS suggested a number of reports and maps but placed special emphasis on a USGS publication entitled *Evaluating Earthquake Hazards in the Los Angeles Region*. This publication contains a series of papers addressing the earthquake hazard in the greater Los Angeles region and cites many publications and products that were useful for generating the lists of earth science products used in this research.

Publication lists and other earth science products of these agencies, where applicable, were also obtained. For example, CDMG produces a variety of maps and reports relevant for our four study counties, including the Alquist-Priolo Earthquake Fault Zones Maps. These and other earth science publications and products are listed in the CDMG publications list that is produced annually. The CDMG products included on our earth science products lists were largely taken from their publication list. Interviews with CDMG personnel were useful in describing their various products and in eliminating products from our lists that did not apply to the counties of interest.

Finally, assistance in generating the lists of earth science products was also received from the Head Librarian at the USGS Library in Menlo Park, California. She conducted searches for earth science products and supplied that information on disk, as well as provided technical assistance on accessing USGS's main library via the Internet. This proved to be an extremely useful tool, and several county-specific searches were conducted using that database.

Using these various sources, comprehensive lists of earth science products covering the four counties were produced. These lists were divided in two parts. The first part of each list
contained regional materials that covered not only parts of the county of interest but other counties as well. Of these regional products, 19 pertained to all four counties under analysis, providing a general picture of the seismic hazard in Southern California. The second part of each publications list was specialized for each county, containing products that specified the seismic hazards in that county. This resulted in each county getting slightly different numbers of items. See Table 2C for the numbers of county-specific products on each list. The majority of products included in these lists were maps, technical reports, and planning scenarios produced either by USGS or CDMG.

TABLE 2C. NUMBER OF COUNTY-SPECIFIC DOCUMENTS ON PUBLICATIONS LISTS

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>NUMBER OF COUNTY-SPECIFIC DOCUMENTS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>County A (City A)</td>
<td>10</td>
</tr>
<tr>
<td>County B (City B)</td>
<td>3</td>
</tr>
<tr>
<td>County C (City C)</td>
<td>8</td>
</tr>
<tr>
<td>County D (City D)</td>
<td>16</td>
</tr>
</tbody>
</table>

*The Alquist-Priolo Earthquake Fault Zones Maps are included as one publication for each county.

*Appendix B provides a breakdown of general products pertaining to each of the four counties under analysis.
Questionnaire Components

The questionnaire was broken into three sections, with questions in Section A asked of all respondents. Questions in this section focused mainly on the publications lists discussed earlier with the primary intent of ascertaining which earth science products local government agencies are using and how useful and important these documents are for office decision-making.

In the interview situation, each respondent was asked to identify publications on the county-specific lists that the office has, as well as to enumerate any documents not on the lists but maintained by the office. Respondents were then asked to list those reports that the office had used in its activities in the last five years. Of these reports, respondents were asked how they were used by the office, how useful each report was, and how important the report was as a factor in office decision-making. The usefulness of documents was determined by using a four-point likert-scale question ranging from “very useful” to “not useful at all.” Similarly, the importance of documents was also determined by using a four-point likert-scale question ranging from “very important” to “not important at all.”

In the last part of Section A, respondents were asked to provide information on organizational sources of seismic and geologic hazard information. During the interview, the respondent was provided a list of organizations and asked to name those that the office had been in contact with in the last five years for earth science information. Respondents were also asked to provide the names of organizations not on the list that their office may have had contact with to get similar information. Next, informants were asked to describe the information received from each organization, how the information was obtained, how the information was used (if at all),
and how useful the information was for office decision-making (if used). Again, the usefulness of the information received was determined using the four-point likert scale item described above.

Section B of the interview guide focused on different ways that seismic and geologic hazard information was being used by the cities and counties. For example, respondents were asked to report the extent to which earth science information has been used in decision making regarding land use and zoning; development and redevelopment issues; and investments in public facilities, infrastructure, and public works. For each of these major areas of decision-making, interviewees were asked how important seismic and geologic hazard information is compared to other considerations. Again, importance scores were determined using a four-point likert-scale question ranging from “very important” to “not important at all.” Respondents were asked to cite recent examples in which seismic and geologic hazard information had played a particularly important role in the decision making process.

Other questions in this section focused on the seismic safety element (SSE) of the jurisdiction’s general plan and whether the jurisdiction has any hazardous buildings programs. The extent to which earth science information was used in the development and revision of the SSE and hazardous building programs was also determined. The final questions in this section were designed to identify the overall usefulness and importance of earth science information for the work done in the respondent’s office, and to determine how such information could be made more accessible.

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Questions in this section were asked of all respondents with the exception of emergency managers and risk managers.
Finally, questions in Section C of the interview guide were directed only to emergency and risk managers in order to determine the extent to which earth science information is used in hazard assessment, emergency preparedness planning, recovery planning, training, public education, and insurance decision-making. Emergency and risk managers, as with other respondents, were asked to rate the overall usefulness and importance of earth science information for the work they do, and to provide suggestions for improving the accessibility of such information.
CHAPTER 3
THE IMPORTANCE OF EARTH SCIENCE INFORMATION

This chapter assesses the extent to which the officials in the eight Southern California jurisdictions included in this study find earth science information important. The analysis is divided into four parts. First, the overall importance of earth science information to the jobs of the public officials is addressed. This includes a brief description of which officials find the information most important. Second, the significance of earth science information for decision making is discussed for the following three areas: land use and zoning; development and redevelopment; and investment in public facilities, infrastructure, and public works. Additionally, examples of the use of scientific information in these areas are presented. Third, in the context of decision making in the above three areas, an analysis is provided of other factors involved, including political and economic concerns, that lessen the relative importance of scientific information. Finally, the interview data point to the relative lack of direct utilization of earth science information in the development of seismic safety elements and hazardous building programs.

General Importance of Earth Science Information

During the interviews with local officials, respondents were asked to rate the importance of earth science information for the work done in their office on a four point scale ranging from 1 ("not at all important") to 4 ("very important"). Table 3A presents the average levels of importance public officials assigned to scientific information.
As Table 3A indicates, the average importance score is 2.86 for cities and 2.95 for counties. These scores suggest that at the aggregate level, city and county officials differ little in terms of assessing the general importance of scientific information. In general, city and county respondents rated the information as being moderately important.
Comparing specific jurisdictions, officials in County A and County B, the two counties that have staff geologists, assigned the highest mean levels of importance to earth science information, 3.33 and 3.83 respectively. This pattern is due to the high usage of earth science publications by the geologists, and the central importance of this information to their jobs. It appears that the more an official utilizes earth science information, the more likely he or she is to perceive that this information is important in terms of decision making within local government. For example, county geologists and emergency managers (at the city and county levels) reported the most use of earth science information, and they consistently found the information more important than other officials (see Chapter Four for further discussion).

Officials in County D and City D, which were predominantly rural areas, generally assigned less importance to earth science information (2.00 and 2.33 respectively). These scores, while not dramatically different from other cities and counties, suggest the possibility of a rural-urban distinction with respect to the importance of earth science information to local government officials. For example, one official from County D suggested that the county's small size (in terms of population) and rural nature made the decision-making apparatus in the county highly susceptible to political and economic influence, making scientific information less salient.

Importance of Earth Science Information in Decision Making

Interviewees were asked to rate the importance of earth science information for decision making with respect to three areas: land use and zoning; development and redevelopment; and investment in public facilities, infrastructure, and public works. Consistent with assessments of general importance, a four point scale was used ranging from 1 ("not at all important") to 4 ("very
important". Emergency management and risk management officials were not asked these question because it was assumed that they were not involved in land use and zoning, development and redevelopment, and public investments decision making.

Table 3B indicates that when data are aggregated at the level of all cities and all counties, earth science information is important for all three categories of decision making. Using only mean scores as an indicator, no major differences can be discerned among the three categories or between cities and counties. Both city and county officials do, however, consider earth science information to be slightly more important for land-use and zoning decisions than for decisions on development and public investment.

**TABLE 3B. MEAN IMPORTANCE OF EARTH SCIENCE INFORMATION FOR DECISION MAKING**

<table>
<thead>
<tr>
<th>USAGES</th>
<th>ALL CITIES (N=14)</th>
<th>ALL COUNTIES (N=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Use &amp; Zoning (Q7)</td>
<td>3.25² (8)¹</td>
<td>3.31 (13)</td>
</tr>
<tr>
<td>Development/Redevelopment (Q11)</td>
<td>3.06 (8)</td>
<td>2.90 (10)</td>
</tr>
<tr>
<td>Public Investments (Q15)</td>
<td>3.00 (6)</td>
<td>2.93 (7)</td>
</tr>
</tbody>
</table>

¹ Number of Respondents
² Scale from 1 - 4: 1 = Not at all important; 4 = Very important
The number of officials that were actually able to respond to the questions about these types of decisions is perhaps the most interesting aspect of Table 3B. A number of respondents were unable to answer questions concerning any of the three areas of decision making and often referred the interviewer to another department within their local jurisdiction.

A total of 14 city officials and 14 county officials were asked to rate the importance of earth science information in these decision-making areas. Of these, 8 out of 14 (57%) city officials and 13 out of 14 (93%) county officials responded to the question about the importance of earth science information in land use and zoning decision making. The pattern of response is similar for decisions regarding development and redevelopment, with 8 out of 14 (57%) city officials and 10 out of 14 (71%) county officials responding. With respect to decisions involving investment in public facilities, however, the number of respondents answering the question drops to only 42% of city officials and 43% of county officials. A number of respondents suggested that the Public Works Department within their jurisdictions should be able to address questions about infrastructure and public investment decisions. However, there were some public works officials who were unable to do so. These differences in response rates suggest that earth science information may not be as important to decision making in the area of public investment as it is in the other two areas.

Examples of the Use of Earth Science Information in Decision Making

Most respondents could not cite specific instances when seismic and geologic hazard information played an important role in the three areas of decision making. A few officials, however, did provide examples. In terms of land use and zoning, two officials from City A
described cases involving two different residential subdivisions in which the city, because of the
availability of scientific information, required the developers to submit full environmental impact
reports.

Similarly, an official from County B's Planning Department indicated that the county
utilized scientific information in decisions regarding a residential subdivision, requiring the
developer to meet certain design specifications in terms of access to the development. Also,
according to this same official, County B recently conducted a geologic study of a camp for
chronically mentally ill youth, the results of which affected the use permit for the facility. County
B also relied on scientific information, according to this planning official, when it required a
recycling facility to relocate its water tank because the tank had been situated directly along a
fault. An official in the Planning and Zoning Department of County C suggested that scientific
information was important for the location and design of landfills within the County. County B's
Geologist also highlighted the importance of seismic and geologic hazard information for the
location and design of landfills.

Only two respondents provided examples of the utilization of scientific information in
decisions regarding development and redevelopment within their jurisdictions. In both cases, the
officials cited instances involving the renovation and retrofit of existing hazardous buildings. In
the first case, an official from City A's administrative office indicated that the city relied on
scientific information when it required a business owner to retrofit an old downtown building
before a restaurant could be opened. Similarly, in the second example, an administrator from City
B suggested that building design and geological studies have been important in determining the
extent of retrofit for an older structure that is being converted into a state office building.
As with the other two areas of decision making, most of the officials who were interviewed could not recall specific instances when seismic and geologic hazard information played an important role in decisions regarding their jurisdiction's investments in public facilities, infrastructure, and public works. Again, however, a few respondents did provide examples.

County B's geologist indicated that publications on seismic hazards in the area were important in the county's decision to hire a consultant to conduct geologic studies prior to the construction of a bridge. Similarly, according to a Public Works official, City A made use of scientific information in a decision regarding the expansion of an existing bridge. Because fault maps were available showing that the expansion took the bridge directly over a fault, the city went beyond standard design criteria in strengthening the bridge. An administrator from City B suggested that seismic and geologic hazard information played an important role in the city's location and design of new water reservoirs and the decision to upgrade and retrofit existing ones. Finally, County C, according to a Planning and Zoning official, is currently utilizing geologic information to locate and design a dam.

Factors Affecting the Importance of Earth Science Information

A number of factors have to be considered when assessing the relative importance of scientific information in decision making regarding land use and zoning, development and redevelopment, and public investments. Among these, political considerations are paramount. Many of the respondents pointed to politics, rather than scientific data, as being the most important force driving decision making. Referring to the political nature of decision making, a respondent in County D stated, "What I'm really telling you is that the political animals that we
have in any public agency...have ultimate responsibility, it's their ball game." Additionally, respondents mentioned issues such as financial concerns, environmental impacts, and infrastructural limitations as important considerations in decision making. For example, some respondents indicated that the sitting of public infrastructure, such as lifeline systems, within hazardous areas is inevitable, thereby limiting the relative importance of earth science information in infrastructural decision making.

Some respondents also suggested that earth science information is of limited utility since it merely reinforces common sense notions of mitigating seismic risks. One of the respondents, for example, commented:

"seismic safety and earthquake hazards and that type of thing aren't too far from common sense...the scientific data is really used to support what probably makes sense, so if the scientific data wasn't there you might still get the same solution."

Finally, respondents mentioned the use of consultants as a factor limiting the direct importance of earth science information to their work. Seismic and geologic hazard information is of limited importance to local officials because they assume that the private consultants, hired to produce state-mandated documents for their jurisdictions, have incorporated relevant earth science information. One official from City D, commenting on the limited direct importance of earth science information, stated:

"Basically the information we are bound by is the city's general plan. My mission...is to ensure that anything that comes through the planning department is in compliance with the city's general plan."
The next section highlights this point further by focusing on the importance of earth science information for complying with specific state mandates.

Earth Science Information, Seismic Safety Elements, and Hazardous Building Programs

In addition to questions relating to the importance of earth science information and its use in the three specific areas of decision making discussed above, local officials were asked a number of questions about the utilization of earth science information in the development of their jurisdictions' seismic safety element (SSE) and hazardous building programs. Respondents were asked when the SSE for their jurisdiction was created, who developed it, when it was most recently updated, and what types of earth science information were used in the development of the document. Additionally, interviewees were asked whether their jurisdiction had a program for hazardous buildings, to briefly describe the program, and to discuss what earth science information, if any, was taken into account when the program was adopted.

Seismic Safety Elements (SSE)

In this discussion, a distinction is made between a background knowledge of the development of the SSE, and an awareness of its provisions. Regarding the first issue, few respondents were knowledgeable of the earth science information that was incorporated into their jurisdiction's SSE. This can be attributed to the fact that SSEs in seven of the eight jurisdictions were developed by private consultants. One respondent made this point clear by stating "I'm not really familiar with it...I can tell you that because we had no input into it." Another respondent
simply provided the interviewer with a consultant's bibliography of earth science information used to develop the SSE. Thus, respondents' limited knowledge in this area is not surprising.

Respondents, however, also had a low level of knowledge concerning the specific provisions contained in the SSE. Few respondents were knowledgeable of when the SSE was developed, and when it was last revised. In fact, some respondents were unaware that their city or county had an SSE, even though cities and counties have been required by the state to have seismic safety elements in their general plans. For example, when one city manager was asked about his jurisdiction's SSE, his response was, "Our seismic safety what?" Then, after a brief explanation by the interviewer, he responded by saying, "I don't know that we have one in our general plan." As with land use and development decision making, many officials assume that planning department personnel are ensuring compliance with the guidelines of their jurisdiction's SSE. However, in most cities and counties, few planning department personnel were able to provide any specific information on the provisions and guidelines of the SSE.

The respondents' limited knowledge of the SSEs may have some relevance for the extent to which seismic hazard reduction measures are adopted and implemented in these eight Southern California jurisdictions. Such a finding would be consistent with earlier research on this topic. For example, Wyner and Mann (1986) found that the implementation of SSEs in 13 California jurisdictions was largely ineffective for a variety of reasons, including the low priority given to seismic hazards by planning personnel and other government officials. Mader (1985), noting that SSEs were used more as information sources than decision-making tools, found that the implementation of SSEs led to few specific land use changes. The prominent role of private consultants in the development of SSEs, however, is not highlighted in this earlier research. Since
respondents in seven of the eight jurisdictions under analysis had no direct input into the development of their SSEs, their lack of knowledge and potential lack of implementation of the elements is not surprising.

**Hazardous Building Programs**

Since the State of California has mandated that local jurisdictions identify seismically hazardous buildings and develop some type of plan for dealing with these structures, our respondents were also asked about the hazardous buildings program in their jurisdiction, and the extent to which earth science information was incorporated into its development. Most of the respondents knew that an inventory of hazardous buildings had been completed as mandated by the state. Additionally, respondents were able to provide information on when the inventory was started and the number of hazardous structures that were identified.

While each jurisdiction had some program for dealing with hazardous buildings, few respondents were able to explain the nature of these programs or the extent to which earth science information was used in their development.\(^{10}\) County B, which had four unreinforced masonry (URM) buildings, illustrates this point. While a number of the respondents in the County were aware that there had been an inventory of hazardous buildings, many were unaware that their jurisdiction had adopted a mitigation program for URM buildings. Consequently, the respondents were unable to discuss the contents of the program or what information had gone into developing it.

\(^{10}\)The type of program adopted varied by jurisdiction, ranging from mere notification of owners to mandatory retrofit.
Chapter Summary

This chapter assessed the importance of earth science information in eight Southern California cities and counties. Overall, earth science information was moderately important to the public officials included in the study. In terms of the importance of earth science information in various decision-making areas, respondents found the information slightly more important in the area of land use and zoning than in the areas of development and redevelopment, and investment in public facilities. An important issue that was highlighted is the diffusion of responsibility among local officials for including earth science information in decision making, perhaps due to the tendency of respondents to believe that officials in other positions were taking the information into consideration. Other factors, including political and economic concerns, involved in decision making were found to lessen the relative importance of earth science information.

Additionally, the data point to the relative lack of direct utilization of earth science information by local officials in the development of seismic safety elements. This is due to the fact that the seismic safety elements of nearly all jurisdictions studied were developed by private consultants. Further, while local officials were aware of hazardous building programs, only a few of them were knowledgeable of the actual provisions of these programs, as well as the extent to which earth science information was incorporated in their adoption.
CHAPTER 4

UTILIZATION AND USEFULNESS OF EARTH SCIENCE PUBLICATIONS

This chapter provides an overview of our respondents' actual use and assessments of usefulness of earth science publications within our eight Southern California jurisdictions. The first section discusses the extent of use and usefulness of all of the earth science publications available to the officials interviewed. All publications include regional as well as jurisdiction-specific documents. Later sections will focus on common publications, which are applicable to all the jurisdictions under analysis, as well as specific publications that address hazards unique to a single county. The chapter concludes with a discussion of the factors that affect the use and usefulness of earth science publications, such as the primary users of the information, the diffusion of responsibility among local governmental officials, and the nature of the documents being used.

Officials within each city and county were provided a list of earth science publications that address geologic and seismic hazards in the region under analysis. Respondents were asked to indicate which of these documents were used in decision making in their department, and to rate the usefulness of each publication on a four-point scale, ranging from one ("not at all useful") to four ("very useful").

As discussed in more detail in Chapter Two, lists of products (i.e., earth science resource documents) were compiled from a variety of sources including the California Division of Mines and Geology (CDMG) and the California Seismic Safety Commission (SSC). The United States Geological Survey's (USGS) on-line library service was also consulted. Each publication list

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11Publications lists were developed at the county level since no city-specific documents were identified.
was broken out by the agency providing the publication, with the majority of publications being produced by the USGS and the CDMG. Several types of documents appeared on the lists including maps, planning scenarios, and technical reports.

Use and Usefulness of All Publications

Extent of Use. The analysis of the utilization of these publications will focus on proportional usage as opposed to the total number of mentions of use. The presentation of the number of mentions is misleading since the number of respondents interviewed within each city and county was not uniform. Further, the publications lists covering the four counties vary in the number of reports available. For instance, there were 45 different publications on the County D list, and 31 publications on the County C list. Therefore, the "percent-used" column is presented in Tables 4A, 4B, and 4C, providing a standardized, and thus more comparable, measure of the use of earth science information.\(^\text{12}\)

Table 4A provides a summary of the extent to which city and county respondents are using the earth science publications available to them. Overall usage of all publications is quite low, 4.9%. When comparing all cities to all counties, county respondents appear to be using a higher percentage of the earth science publications available to them, although the difference is not large, 5.7 compared to 4.4 percent. This is not surprising since Counties A and B both have

\(^{12}\)The percent used score is produced by first taking the total number of publications on a list and multiplying by the number of respondents within a jurisdiction. This produces the total possible mentions of use within a jurisdiction. For example, there are four total respondents in County A and 42 items on the publications list. Multiplying 42 by four produces a score of 168, the total number of mentions possible within County A. There are a total of 17 actual mentions of use in County A. Dividing this figure by the total possible number of mentions provides the overall percentage of use of earth science publications within County A. Thus, 17 divided by 168 produces a score of 10.1%.
staff geologists who reported using a higher percentage of earth science publications than all other city and county officials.

A comparison of specific jurisdictions reveals that respondents in County A and City A are utilizing a higher percentage of the publications (10.1% and 7.1%, respectively) on their lists than respondents from the remaining cities and counties. The more extensive use of seismic and geologic hazard publications in City A can largely be attributed to the efforts of the disaster preparedness coordinator, who alone indicated using as many as 10 different publications.

Respondents within City C have the lowest percentage of use among city respondents, with a score of 1.3. Most respondents within City C feel that officials in other City departments use earth science information, a finding also discussed in Chapter Three. Further, some officials are simply misinformed about the actual hazards confronting City C. A building official, for example, suggested that the utilization of earth science information is not necessary because City C "is relatively hazard-free," even though all of Southern California lies within the highest seismic hazard zone.

It is important to note that the percent used figures for Counties A and B are underreported. This is largely due to the presence of staff geologists in these two locales. Both geologists were familiar with and have used all but a few of the publications on their respective lists, but they focused only on those they use on a more regular basis. Further, both geologists had knowledge of and used products that were not on the lists. By not including these extra publications and focusing exclusively on more extensively used documents, the percent used figures underreport actual use in both counties.
TABLE 4A. MEAN USEFULNESS AND EXTENT OF USE OF EARTH SCIENCE INFORMATION (ALL PUBLICATIONS) BY CITIES AND COUNTIES

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>PUBLICATIONS</th>
<th>TOTAL&lt;sup&gt;a&lt;/sup&gt;</th>
<th>TOTAL&lt;sup&gt;b&lt;/sup&gt;</th>
<th>%&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USGS</td>
<td>CDMG</td>
<td>OTHER</td>
<td>USED</td>
</tr>
<tr>
<td>All Cities (N=22)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.05</td>
<td>3.06</td>
<td>4.00</td>
<td>3.11&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>City A (N=6)</td>
<td>3.33</td>
<td>4.00</td>
<td>4.00</td>
<td>3.67</td>
</tr>
<tr>
<td>City B (N=5)</td>
<td>4.00</td>
<td>3.25</td>
<td>0.00</td>
<td>3.63</td>
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<tr>
<td>City C (N=5)</td>
<td>0.00</td>
<td>3.50</td>
<td>0.00</td>
<td>3.50</td>
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<tr>
<td>City D (N=6)</td>
<td>2.00</td>
<td>1.00</td>
<td>0.00</td>
<td>1.60</td>
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<tr>
<td>All Counties (N=23)</td>
<td>3.58</td>
<td>3.54</td>
<td>3.33</td>
<td>3.54</td>
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<tr>
<td>County A (N=4)</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
</tr>
<tr>
<td>County B (N=7)</td>
<td>3.67</td>
<td>3.55</td>
<td>3.00</td>
<td>3.56</td>
</tr>
<tr>
<td>County C (N=8)</td>
<td>3.60</td>
<td>3.50</td>
<td>0.00</td>
<td>3.54</td>
</tr>
<tr>
<td>County D (N=4)</td>
<td>0.00</td>
<td>4.00</td>
<td>0.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Total (N=45)</td>
<td>3.31</td>
<td>3.35</td>
<td>3.60</td>
<td>3.35</td>
</tr>
<tr>
<td>Total Possible</td>
<td>943</td>
<td>557</td>
<td>228</td>
<td>4.2</td>
</tr>
</tbody>
</table>

<sup>a</sup> This indicates the total number of mentions of documents used by respondents within that jurisdiction.

<sup>b</sup> This is computed by multiplying the total number of documents available by the total number of respondents many as 10 different publications.

<sup>c</sup> This is computed by dividing "total used" by "total possible," providing a standardized score of usage.

<sup>d</sup> Mean usefulness score for earth science publications within that jurisdiction. The usefulness of each earth science publication was rated on a four-point scale with 1 representing "not at all useful" and 4 representing "very useful."

<sup>e</sup> Total number of respondents within that jurisdiction.

<sup>f</sup> Number of mentions.
Overall, County D respondents reported the lowest percentage of use of earth science information (0.5%). This is a consistent finding throughout the analysis. County D officials provided a number of reasons for their relative lack of utilization, many of which were reported by respondents from other jurisdictions. These reasons will be discussed in detail in the final section of this chapter. County D officials did, however, suggest some reasons for lack of utilization not mentioned by respondents from the other areas. For example, officials in County D indicated that their seismic risk is minimal since the County is largely rural, containing no densely populated areas and only a small business district in the county seat (City D) with no high-rise buildings. In the same vein, the rural nature of the county led another respondent to suggest that the decision-making apparatus is more susceptible to political and financial influence, thereby limiting the utilization of earth science information in County decision making. Further, the officials in County D suggested that earth science information is of limited utility since it merely reinforces common sense notions of mitigating seismic risks.

Finally, when comparing percentages of publications used, broken out by publication source, a higher percentage of CDMG publications is being used than USGS publications. Interestingly, the raw numbers also show a higher number of mentions of use of CDMG publications (43) in comparison to USGS publications (37) even though, overall, there are fewer CDMG than USGS publications available to city and county respondents. With the exception of County D and City D, this may be due to the greater number of county-specific documents produced by CDMG, a topic addressed in the discussion of Table 4C.
General Assessments of Usefulness. Table 4A also provides a breakdown of respondents' ratings of usefulness of all earth science publications by jurisdiction and publication source. The overall mean usefulness score for all cities is 3.11 compared to 3.54 for all counties. Although county respondents find all publications to be more useful for decision making, the differences are slight. However, the overall mean usefulness score for the cities is strongly influenced by a single respondent in City D. When City D is dropped from the analysis, the mean usefulness score for the remaining three cities is 3.64, higher than that of the counties.

In looking at Table 4A for comparisons of specific jurisdictions, it is difficult to identify any clear-cut differences or patterns in terms of overall usefulness. With the exception of City D, there are no mean usefulness scores below 3.50 on a four point scale. The total mean usefulness score for earth science publications in City D is 1.60, far below the scores for other cities and counties. Again, this is largely due to a single respondent that reported using a number of publications for identifying the location of earthquake faults. Given that the majority of publications he reported using were developed for more specific purposes than merely fault identification, it is not surprising that he provided such low ratings of usefulness.

Table 4A also provides usefulness ratings by source of publication (i.e., USGS, CDMG, Other). Little variation in the usefulness of all publications is evident when focusing on the product source. Looking at the total usefulness scores, for example, respondents find CDMG (3.35) and USGS (3.31) publications equally useful. This point is reinforced when comparing all cities to counties, excluding City D. Both county and city respondents rate USGS documents

\[13\text{Comparisons of the usefulness scores of "other" (non-USGS and -CDMG) publications is not included in this section or in the discussions of common and specific publications given the few mentions of actual usage (all, 5; common, 1; specific, 0).}\]
between useful and very useful (3.58 and 3.54, respectively). Although the difference is somewhat larger, both city respondents (3.69), especially those in City A (4.00), and county respondents (3.54) also rate CDMG publications between useful and very useful.

**Summary of Overall Usefulness.** Although respondents' use of all publications is low (4.9%), a higher percentage of all publications is being used in Counties A and B, as well as City A. The higher percentage of publications used in Counties A and B can largely be attributed to the staff geologists in these two locales. None of the remaining jurisdictions have a geologist on staff. The higher overall percentage of use in City A is largely due to the efforts of the disaster preparedness coordinator who is a "champion" of emergency preparedness within that city. These staff geologists and emergency management personnel are what Hayes (1988a) refers to as internal advisors or advocates who play an important role in the use of seismic hazard information.

Mean usefulness scores of earth science publications, broken out by jurisdiction and publication source, are very similar; that is, with the exception of City D, respondents rate most of the documents they are using between useful and very useful for decision making within their offices. This may be due to the fact that respondents refer only those publications they find useful. It can be assumed that city and county officials screen documents for their potential usefulness, discarding those publications they feel are not pertinent to their job-related needs.

**Usefulness of Common Publications**

**Extent of Use.** A series of publications common to all four of the counties were included on each county's publications list. This section provides an analysis of the utilization of these
common earth science products. Percentages of common publications used are presented in Table 4B.

Although county respondents (4.4%) reported utilizing a greater percentage of common publications than did city respondents (3.6%), the total percentage of common publications used is low (4.0%). These figures suggest that city and county respondents are using relatively few of the common publications available to them. In looking at the percent used figures for specific jurisdictions, respondents from City A, County B, and County C are utilizing a higher percentage of common publications than respondents from the other cities and counties. In contrast, respondents from City and County D reported little to no use of common publications, 1.9% and 0.0% respectively.

The City A score is strongly influenced by the disaster preparedness coordinator, who uses a number of planning scenarios and large-scale fault maps which tend to cover all of the jurisdictions in the study. This influence by emergency management personnel may also explain the greater proportional usage of common publications in Counties B and C. Emergency management personnel from both of these counties indicated using generalized earthquake and epicenter maps, as well as planning scenarios, for public educational purposes.

Focusing on publication sources in Table 4B, city and county respondents reported a higher percentage of use of CDMG (6.1%) than USGS (3.5%) publications. This finding will be discussed further is the section on the usage of specific documents.

Usefulness of Common Publications. The mean usefulness scores for common publications are also presented in Table 4B, broken out by jurisdiction and publication source. In comparing all cities to all counties, there is no difference in how respondents rate the usefulness of
common earth science publications (3.47). Consistent with findings from Table 4A, usefulness scores are very high. In general, city and county respondents rate the common publications they are using between useful and very useful.

Comparing specific jurisdictions, mean usefulness scores for each city and county are also very similar, with the exception of where respondents do not use any of the common publications. This is consistent with findings from Table 4A, indicating that respondents in County D are simply not utilizing earth science publications in their work.

In looking at the remaining jurisdictions, it is clear that city and county respondents find these common or more regional publications to be moderately useful. Usefulness scores range from a low of 3.00 in City D to a high of 4.00 in City C. Caution should be taken in interpreting these scores, however, considering the low number of mentions in some jurisdictions. For example, although City C has a score of 4.00, it is based on a single mention of use.

Information on the source of common publications is also provided in Table 4B. Findings suggest that there is no difference in the usefulness ratings of CDMG and USGS publications when combining city and county respondents (3.45). Comparing all cities to counties, county respondents (3.55) find USGS publications somewhat more useful than their counterparts at the city level (3.36). Common CDMG publications, on the other hand, were rated more useful by city respondents (3.75) than by county officials (3.29). Although the differences in these mean usefulness scores, when comparing all cities to counties, are larger than those reported for all publications, respondents still rated common CDMG and USGS products between useful and very useful.
<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>PUBLICATIONS</th>
<th>TOTAL(^a)</th>
<th>TOTAL(^b)</th>
<th>%(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USGS</td>
<td>CDMG</td>
<td>OTHER</td>
<td>USED</td>
</tr>
<tr>
<td>All Cities (N=22)</td>
<td>3.36</td>
<td>3.75</td>
<td>0.00</td>
<td>3.47(^d)</td>
</tr>
<tr>
<td>City A (N=6)</td>
<td>3.25</td>
<td>4.00</td>
<td>0.00</td>
<td>3.33</td>
</tr>
<tr>
<td>City B (N=5)</td>
<td>4.00</td>
<td>3.50</td>
<td>0.00</td>
<td>3.75</td>
</tr>
<tr>
<td>City C (N=5)</td>
<td>0.00</td>
<td>4.00</td>
<td>0.00</td>
<td>4.00</td>
</tr>
<tr>
<td>City D (N=6)</td>
<td>3.00</td>
<td>0.00</td>
<td>0.00</td>
<td>3.00</td>
</tr>
<tr>
<td>All Counties (N=23)</td>
<td>3.55</td>
<td>3.29</td>
<td>4.00</td>
<td>3.47</td>
</tr>
<tr>
<td>County A (N=4)</td>
<td>3.50</td>
<td>3.00</td>
<td>0.00</td>
<td>3.33</td>
</tr>
<tr>
<td>County B (N=7)</td>
<td>3.60</td>
<td>3.33</td>
<td>4.00</td>
<td>3.56</td>
</tr>
<tr>
<td>County C (N=8)</td>
<td>3.50</td>
<td>3.33</td>
<td>0.00</td>
<td>3.43</td>
</tr>
<tr>
<td>County D (N=4)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total (N=45)</td>
<td>3.45</td>
<td>3.45</td>
<td>4.00</td>
<td>3.47</td>
</tr>
<tr>
<td>Total Possible % Used</td>
<td>6.1</td>
<td>180</td>
<td>45</td>
<td>3.5</td>
</tr>
</tbody>
</table>

\(^{a}\) This indicates the total number of mentions of documents used by respondents within that jurisdiction.

\(^{b}\) This is computed by multiplying the total number of documents available by the total number of respondents within that jurisdiction.

\(^{c}\) This is computed by dividing "total used" by "total possible," providing a standardized score of usage.

\(^{d}\) Mean usefulness score for earth science publications within that jurisdiction. The usefulness of each earth science publication was rated on a four-point scale with 1 representing "not at all useful" and 4 representing "very useful."

\(^{f}\) Number of mentions.
Summary of Usefulness of Common Publications. In sum, the total percent used figure for common publications is very low (4.0%). This low percentage of use is evidenced by the scores for City C, City D, and County D. Respondents from these three jurisdictions reported using a total of only two common publications. Although the percentage of use is low, respondents rated the common products they are using quite highly, between useful and very useful.

Use and Usefulness of Specific Publications

Extent of Use. Table 4C provides information on the utilization of specific publications that identify hazards unique to a particular county. The total percentage of use of specific publications is 8.5%, more than double the figure reported for common publications (4.0%). Comparing all cities to all counties, county respondents (10.6%) are using a higher percentage of specific publications than city officials (6.6%). This discrepancy can be attributed to the staff geologists in Counties A and B, whose main responsibilities are to review development plans and geologic site reports, and to help maintain Geographical Information Systems (GIS) for the development of hazard zones (see discussion of primary users below). The specific publications, which identify localized hazards, are very important for this latter function. It is not surprising, therefore, that the percentages reflect a greater usage of specific publications in these two counties.

While the percent used figure of specific publications is higher for county respondents than city respondents, officials from Cities A (10.0%) and B (13.3%) are using a higher percentage of specific earth science publications than officials in Cities C (0%) and D (6.3%), and Counties C
(6.3%) and D (1.6%). As discussed in the common publications section, the higher percentage of specific earth science documents used in Cities A and B can largely be attributed to the efforts of emergency management personnel.

Focusing on publication sources, city and county respondents reported a higher percentage of use for specific CDMG (10.6%) than USGS (6.1%) publications. This is not surprising since CDMG, consistent with its organizational mission, is producing more jurisdiction-specific publications, something that many respondents find useful for decision making at the local level.

**Usefulness of County-Specific Publications.** Once again mean usefulness scores are provided in Table 4C and broken out by jurisdiction and publication source. Comparing all county to all city respondents, officials at the county level appear to find specific earth science publications to be more useful than their city counterparts (3.60 and 2.86, respectively). However, the cities' figure is strongly influenced by respondents in City D, where usefulness is given a very low rating. When City D is removed from the analysis, the overall mean usefulness score for all cities jumps from 2.86 to 3.75, slightly higher than the mean usefulness score for all county respondents (3.60). The distinctions, however, are minimal. For the most part, respondents from both cities and counties rate specific earth science publications between useful and very useful.

Consistent with findings discussed in previous sections, mean usefulness scores for specific jurisdictions range from 3.00 to 4.00, with the exception of City D (1.60). Therefore, no real distinctions can be made regarding the usefulness scores of respondents in specific jurisdictions.
However, caution should be used in interpreting these usefulness scores considering the low number of mentions in some jurisdictions (e.g., County D, 1; City B, 2).

In terms of publication sources, city and county respondents rated specific CDMG (3.56) publications more useful than USGS (2.70) products. However, the low mean usefulness score for USGS can be attributed to a single respondent in City D who rated the five documents used between "not at all useful" or "not very useful." When the figure for City D is excluded from the analysis, the total mean usefulness score for USGS is 3.60, comparable to the score for CDMG (3.56).

When comparing all county to city respondents, county officials show a greater propensity than their city counterparts to find both CDMG and USGS specific publications more useful. However, as discussed previously, the usefulness scores for all cities are strongly influenced by respondents in City D. In fact, the only city officials who reported using specific USGS publications were from City D\(^{14}\); therefore, the low USGS usefulness score for all cities is not surprising.

Excluding City D respondents, there is little variation in usefulness scores when comparing specific jurisdictions or publication source. Scores consistently ranged between 3.00 and 4.00, suggesting that city and county officials rate the specific documents they are using between useful and very useful.\(^{14}\)

\(^{14}\)The vast majority of specific USGS publications identified covered County D (12). Three specific USGS products were identified for County A, one for County C, and none for County B.
### TABLE 4C. MEAN USEFULNESS AND EXTENT OF USE OF EARTH SCIENCE INFORMATION (SPECIFIC PUBLICATIONS) BY CITIES AND COUNTIES

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>PUBLICATIONS</th>
<th></th>
<th></th>
<th>TOTALa</th>
<th>TOTALb</th>
<th>%a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USGS</td>
<td>CDMG</td>
<td>OTHER</td>
<td>USED</td>
<td>POSSIBLE</td>
<td>USED</td>
</tr>
<tr>
<td>All Cities</td>
<td>1.80</td>
<td>3.44</td>
<td>0.00</td>
<td>2.86a</td>
<td>211</td>
<td>6.6</td>
</tr>
<tr>
<td>(N=22)</td>
<td>(5)</td>
<td>(9)</td>
<td>(0)</td>
<td>(14)f</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City A</td>
<td>0.00</td>
<td>4.00</td>
<td>N.A.</td>
<td>4.00</td>
<td>60</td>
<td>10.0</td>
</tr>
<tr>
<td>(N=6)</td>
<td>(0)</td>
<td>(6)</td>
<td>(6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City B</td>
<td>N.A.</td>
<td>3.00</td>
<td>N.A.</td>
<td>3.00</td>
<td>15</td>
<td>13.3</td>
</tr>
<tr>
<td>(N=5)</td>
<td>(2)</td>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City C</td>
<td>0.00</td>
<td>0.00</td>
<td>N.A.</td>
<td>0.00</td>
<td>40</td>
<td>0.0</td>
</tr>
<tr>
<td>(N=5)</td>
<td>(0)</td>
<td>(0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City D</td>
<td>1.80</td>
<td>1.00</td>
<td>0.00</td>
<td>1.60</td>
<td>96</td>
<td>6.3</td>
</tr>
<tr>
<td>(N=6)</td>
<td>(5)</td>
<td>(1)</td>
<td>(0)</td>
<td>(6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Counties</td>
<td>3.60</td>
<td>3.60</td>
<td>0.00</td>
<td>3.60</td>
<td>189</td>
<td>10.6</td>
</tr>
<tr>
<td>(N=23)</td>
<td>(5)</td>
<td>(15)</td>
<td>(0)</td>
<td>(20)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>County A</td>
<td>3.50</td>
<td>3.58</td>
<td>N.A.</td>
<td>3.55</td>
<td>40</td>
<td>25.0</td>
</tr>
<tr>
<td>(N=4)</td>
<td>(4)</td>
<td>(6)</td>
<td>(10)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>County B</td>
<td>N.A.</td>
<td>3.60</td>
<td>N.A.</td>
<td>3.60</td>
<td>21</td>
<td>23.8</td>
</tr>
<tr>
<td>(N=7)</td>
<td>(5)</td>
<td>(5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>County C</td>
<td>4.00</td>
<td>3.60</td>
<td>N.A.</td>
<td>3.75</td>
<td>64</td>
<td>6.3</td>
</tr>
<tr>
<td>(N=8)</td>
<td>(1)</td>
<td>(3)</td>
<td>(4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>County D</td>
<td>0.00</td>
<td>4.00</td>
<td>0.00</td>
<td>4.00</td>
<td>64</td>
<td>1.6</td>
</tr>
<tr>
<td>(N=4)</td>
<td>(0)</td>
<td>(1)</td>
<td>(0)</td>
<td>(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2.70</td>
<td>3.56</td>
<td>0.00</td>
<td>3.31</td>
<td>400</td>
<td>8.5</td>
</tr>
<tr>
<td>(N=45)</td>
<td>(10)</td>
<td>(24)</td>
<td>(0)</td>
<td>(34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Possible</td>
<td>163</td>
<td>227</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Used</td>
<td>6.1</td>
<td>10.6</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Used</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* This indicates the total number of mentions of documents used by respondents within that jurisdiction.
* This is computed by multiplying the total number of documents available by the total number of respondents within that jurisdiction.
* This is computed by dividing "total used" by "total possible," providing a standardized score of usage.
* Mean usefulness score for earth science publications within that jurisdiction. The usefulness of each earth science publication was rated on a four-point scale with 1 representing "not at all useful" and 4 representing "very useful."
* Total number of respondents within that jurisdiction.
* Number of mentions.
Summary of County-Specific Publications. Overall, there is a higher percentage of county-specific publications used in comparison to common publications (those that cover the entire four-county area). This is to be expected since the specific publications are extremely useful to the two staff geologists whose counties are maintaining GIS systems.

Since CDMG is producing a greater proportion of these specific documents than USGS, the greater utilization of specific CDMG products by city and county officials is not surprising. Comparing usefulness ratings by jurisdiction and publication source, few distinctions were observed since city and county officials rated the specific documents they are actually referred to as useful and very useful.

Chapter Summary

This chapter presented an overview of respondents' utilization and assessments of usefulness of all earth science publications, and separately for those publications common to all four counties as well as those that are county-specific. In general, respondents are utilizing few of the earth science publications available to them for office or agency decision making. This is evidenced by the low total percent (4.9%) for all earth science publications used. However, utilization did vary by jurisdiction (related to the primary user) and type of document (common versus specific). For example, jurisdictions with staff geologists and active emergency management personnel reported greater proportional usage of earth science publications than other jurisdictions. Further, respondents reported using a higher percentage of specific documents (8.5%) than common publications (4.0%). Respondents were clear in stating that localized, more detailed information is necessary for decision making at the local level.
Respondents' ratings of the usefulness of earth science publications varied little by type of
document or jurisdiction. Consistently, mean usefulness scores ranged from 3.00 to 4.00,
indicating that respondents rate the documents they are using between useful and very useful.
CHAPTER 5

CONTACTS WITH ORGANIZATIONS

This chapter focuses on local officials' contacts with various organizations for the purposes of obtaining seismic and geologic hazard information, and their assessments of the usefulness of that information. First, the extent of organizational contacts reported by city and county officials is presented. Second, the usefulness of the information obtained through organizational contacts is discussed. Finally, factors related to the use of organizational contacts and the usefulness of the information obtained are identified.

On the basis of the Disaster Research Center's previous research and knowledge of information transfer efforts in Southern California, a list of possible organizational contacts (Appendix D) for earth science information was developed and then mailed to each potential interviewee for consideration prior to the interview. Included on the list were 18 federal and state government agencies such as FEMA, OES, and CDMG; universities and university-based research centers (e.g., the Southern California Earthquake Center); and a variety of other public and private sector entities, including consulting firms and newspapers. For the purposes of comparison, university contacts were subsumed under a single category, and "professional associations" were desegregated from the "other organizations" category.15

During the interviews, respondents were specifically asked whether they had any contact with these organizations, or other organizations not listed, for purposes of obtaining information

15This category includes organizations not on the original list and distinct from professional associations.
on seismic or geologic hazards. They were also asked who initiated the contacts, what type of response they received, and whether they made use of any information obtained. If obtained information was used, respondents were asked to rate the usefulness of this information on a scale ranging from one ("not at all useful") to four ("very useful").

**Extent of Use of Organizational Contacts**

A look at the overall use of organizational contacts (Table 5A) indicates that the 45 respondents reported a total of 100 organizational contacts. These figures mask, however, the fact that a third (14) of the respondents did not mention any organizational contact, while three emergency management officials each mentioned at least eight organizational contacts. These three respondents together accounted for more than a fourth (26%) of the total contacts. Further, contacts mentioned by seven respondents (having five or more contacts) accounted for nearly half (48%) of all contacts.

The percentage of respondents reporting organizational contacts in each jurisdiction is summarized in Table 5B. Additionally, a standardized measure of the extent of organizational contacts is presented for purposes of direct comparison.\textsuperscript{16} From this table it can be noted that the 100 actual contacts reported by all respondents comprise about 14% of the total possible organizational contacts (720).

\textsuperscript{16} The percent of organizational contacts used is computed by first multiplying the number of respondents within a jurisdiction by the number of organizations (16). This produces the total number of possible organizational contacts within a jurisdiction. The actual number of organizational contacts reported within a jurisdiction is then divided by the total possible number of contacts, producing the percent used figure.
<table>
<thead>
<tr>
<th>Number of Contacts</th>
<th>Number of Respondents</th>
<th>Cumulative Percentage of Respondents</th>
<th>Cumulative Frequency of Contacts (Contacts X Respondents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>14</td>
<td>31%</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>44</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>64</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>82</td>
<td>48</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
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<td>6</td>
<td>2</td>
<td>93</td>
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</tr>
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<td>0</td>
<td>93</td>
<td>74</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>96</td>
<td>82</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>100%</td>
<td>100</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>45</strong></td>
<td></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>Organization</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>California Agencies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OES/SCEPP</td>
<td>50.0%</td>
<td>40.0</td>
<td>20.0</td>
</tr>
<tr>
<td>(3)</td>
<td>(2)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>CSTI</td>
<td>83.3</td>
<td>20.0</td>
<td>20.0</td>
</tr>
<tr>
<td>(5)</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td>CDMG</td>
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<td>40.0</td>
<td></td>
</tr>
<tr>
<td>(1)</td>
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</tr>
<tr>
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<td>20.0</td>
<td>16.7</td>
</tr>
<tr>
<td>(2)</td>
<td>(1)</td>
<td>(1)</td>
<td>(3)</td>
</tr>
<tr>
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| Percent Used | 21.9 | 22.5 | 5.0 | 9.4 | 14.8% | 14.1 | 15.2 | 12.5 | 9.4 | 13.0% | 13.9% |
| # of Contacts | 21   | 18   | 4   | 9   | 52    | 9    | 17   | 16   | 6   | 48    | 100   |
| Total Possible  | 96   | 80   | 80  | 96  | 384   | 64   | 112  | 128  | 64  | 384   | 720   |

Note: Number of respondents
Table 5B further shows that of the 100 contacts, the Governor's Office of Emergency Services (OES), which includes the Southern California Earthquake Preparedness Project (SCEPP), had the most number of mentions (16), followed by: the California Specialized Training Institute (CSTI), 12; the California Division of Mines and Geology (CDMG), 11; the United States Geological Survey (USGS), 10; "Other organizations," 10; Professional Associations, 9; and the Federal Emergency Management Agency (FEMA), 8. Respondents reported no contact with two organizations: the Building Seismic Safety Council (BSSC) and the California Department of Insurance.

Despite the importance attached to consulting firms in Chapters Three and Four, only four respondents mentioned having contacts with this type of organization for the specific purpose of obtaining seismic and geological hazard materials. This should not be surprising, however, since local officials would not contact private consultants to obtain seismic and geologic hazard information but instead would hire them to use it on their behalf. As highlighted in Chapter Three, seven of the eight jurisdictions in this study hired private consultants to develop their seismic safety elements.

Several similarities are found when comparing all city to all county respondents. For example, about 15% of all city respondents and 13% of all county respondents reported some type of organizational contacts for the purpose of obtaining or receiving earth science information. The extent of organizational contacts for cities and counties was also similar for OES/SCEPP (36.4% and 34.8%), SCEC (9.0% and 8.7%), BICEPP (4.6% and 4.3%), and professional associations (18.2% and 21.7%).
There are also several significant differences between cities and counties regarding use of organizational contacts. First, while four out of the 23 (17%) county respondents mentioned contact with CSTI, such contact was mentioned by twice as many (36%) city respondents. This difference could be attributed chiefly to City A (five contacts), in which the emergency manager is considered to be highly committed and proactive. Moreover, contact with CSTI was mentioned by respondents in all four cities, whereas respondents in only two of the four counties mentioned such contact.

A second difference between cities and counties relates to contact with CDMG, which was mentioned by 34.8% of county respondents in comparison with just 13.6% of city respondents. This difference may be related to the presence of staff geologists in Counties A and B who, as discussed in Chapter Four, make greater use of CDMG resources. Third, contact with FEMA was mentioned by 22.7% of city respondents, compared with 13% of county respondents. This difference can be attributed to the efforts of proactive emergency managers in Cities A and B. Consequently, the highest percentages of organizations contacted are associated with these two jurisdictions (in City A, 21.9% and in City B, 22.5%). Similar to findings by Spangle Associates (1988), these emergency management personnel could be considered "advocates" for earthquake hazard mitigation who are more involved in the reduction of seismic hazard impacts than other government officials. Finally, contact with the Seismic Safety Commission (SSC) was mentioned only by city respondents (13.6%).
Usefulness of Organizational Contacts

Table 5C presents city and county respondents' assessments of the usefulness of information obtained through organizational contacts. The table also indicates the number of contacts mentioned by respondents (in parenthesis below each score), as well as aggregate usefulness scores for the four cities and four counties.

As is shown in Table 5C, respondents' ratings of the usefulness of information obtained through organizational contacts consistently fall within the range of 3.00 to 4.00. Therefore, it is difficult to meaningfully assess the relative usefulness of earth science information obtained from various organizational sources. The fact that the information obtained was used is itself an indication that it was useful.

For meaningful comparisons between all cities and counties, only those organizations that had a score of eight or more contacts are discussed. Among these organizations, information obtained from USGS had the highest overall rating for usefulness (3.9 out of a possible 4.0), followed by CAOES/SCEPP (3.8) and FEMA (3.8). A rating of 3.7 was given to information obtained through CSTI, CDMG, and "other" organizations. Finally, information acquired from professional associations had a mean usefulness score of 3.6. Again, there is very little difference in respondents' ratings of the usefulness of information obtained through these primary organizational contacts.
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1Number of Respondents
2Mean usefulness score on a scale of 0-4
3Number of organizational contacts mentioned
Factors Affecting the Use and Usefulness of Organizational Contacts

Routine vs. Specific Contacts. Organizational contacts for earth science information can be broadly classified as routine or specific. Routine contacts are those that are maintained through periodic receipt of publications and/or newsletters from organizations. For example, most of the emergency management officials have routine contact with OES/SCEPP and CSTI. Both geologists interviewed mentioned that their contacts with USGS and CDMG were sustained by receiving annual and monthly publications from these organizations. The vast majority of organizational contacts are routine in nature, with organizations regularly providing information to the local jurisdictions. For example, OES and CSTI regularly organize training seminars and exercises on emergency response attended by city and county officials.

Specific contacts are chiefly initiated by local officials for specific needs. For example, following the Landers/Big Bear earthquake, one official contacted OES for information on loss estimation procedures, and another official contacted USGS for studies on strong ground motion pertaining to his jurisdiction. Contact with CSTI focused on training and emergency planning. CDMG and USGS were often contacted for maps and other scientific publications.

Personal vs. Impersonal Contacts. Organizational contacts can further be classified as personal or impersonal. Personal contacts involve those in which a local official personally knows one or more persons in the organization contacted. Several respondents reported such contacts, chiefly with organizations related to their profession. For example, the risk manager of one city listed six professional risk associations with which he was closely associated; these personal organizational contacts assisted him in his decision making. Since all professional associations were collapsed into a single category, this official's six contacts were coded as a single
organizational contact. Thus, the extent of contact that this official had with various professional associations is not fully reflected in the tables.

Personal contacts were often facilitated by professional meetings, seminars, and training programs. Stressing the importance of attendance at professional meetings for decision making, one risk manager mentioned, "Some of it is information and some it is talking to peers, and if you've ever got a question...[you ask], 'who else has done it?'" An emergency management official emphasized that he obtained a lot of assistance from "face-to-face" contact with private consultants. These findings are consistent with earlier research. For example, Nigg (1988) asserts that direct, interpersonal contacts are important in increasing the utilization of earth science information.

In contrast with personal contacts, impersonal contacts involve those in which a local official does not know anyone in the organization contacted. Contacts for the purpose of obtaining specific publications were often impersonal. For example, very few respondents mentioned any personal contacts with officials in CDMG or USGS, who were contacted chiefly for publications and maps. Overall, respondents indicated more personal than impersonal organizational contacts.

A Note on the Under-Representation of Contacts

As mentioned above, organizational contacts by city and county officials are under-reported in Table 5C. This can be attributed to several factors. First, even when several professional associations were mentioned by one respondent, these contacts were assigned a
single mention in the table. This procedure was used to standardize the number of possible organizational contacts for the sake of comparability across jurisdictions.

Second, a large number of organizational contacts were excluded from the table because they were not related to seismic or geologic hazards. This criteria also limited the list of possible organizational contacts for local officials whose responsibility only tangentially involved earth science information. For example, a plan check engineer in a building department mentioned that his responsibility was for enforcement of the city ordinances, not the enactment of codes, making scientific information unnecessary for his work. A director of community development said that as the second trustee for development projects his office did not need to have detailed knowledge of seismic or geologic hazards. This official followed recommendations made by private consultants regarding compliance with seismic ordinances.

A third limitation is the procedure for channeling earth science information within some cities and counties. In one city, for example, the fire department, which is headed by the assistant director for disaster preparedness, is the main conduit for disaster-related information. In another city the emergency manager's office is the main repository of earth science information. One county official relies on assessments by the county geologist for all earth science-related questions. Formal or informal procedures for obtaining earth science information do not restrict the range of organizational sources of information. Thus, the use of organizational contacts for earth science information may be more extensive than suggested by the data.
Chapter Summary

The use of organizational contacts and the usefulness of the information obtained from them were discussed in this chapter. First, significant variation was found in the number of organizational contacts reported by city and county respondents. Approximately one-third of the respondents had no organizational contact, while three respondents accounted for 26% of all contacts. Second, the organizations that were most frequently contacted for earth science information were the Governor's Office of Emergency Services (OES/SCEPP), California Specialized Training Institute (CSTI), the California Division of Mines and Geology (CDMG), and the United States Geological Survey (USGS). Based on the types of organizations that were contacted, there was some significant variation between all cities and all counties. Third, there was little variation in the usefulness ratings of information obtained through organizational contacts; all were routinely assessed to be highly useful. Nonetheless, USGS information had the highest overall usefulness rating, followed by OES/SCEPP, and FEMA. Finally, two factors that affect the use and usefulness of the organizational contacts were elaborated: the type of contact (personal or impersonal), and the purpose (routine or specific) for which the contact was made.
CHAPTER 6
FACTORS AFFECTING THE USE AND USEFULNESS OF EARTH SCIENCE PUBLICATIONS

A number of interrelated factors affecting the use and usefulness of earth science publications were identified throughout the analysis. These include the primary users of the information; the diffusion of responsibility among city and county officials; the nature of earth science documents; the accessibility of these documents; the influence of state mandates; officials' perceptions of risk; and the characterization of the jurisdictions as either urban or rural.

**Primary Users**

As indicated in the discussions in the preceding chapters, the primary users of earth science publications within local governments are emergency management personnel and staff geologists. City and county officials also rely heavily on private consultants when seismic and geologic hazard information is necessary for local decision making.

The presence of a staff geologist in Counties A and B results in greater use of earth science information. These geologists primarily use earth science information to maintain Geographical Information Systems (GIS) and for plan and geologic report review. For example, maps are converted into digitized form and entered into a GIS. This information is used to produce, update, and maintain hazard maps which are used in conjunction with other county maps. Hazard zones and corresponding maps have been produced for liquefaction, slope stability, and the Alquist-Priolo fault zones.
As was discussed in Chapter Three, private consultants have been used extensively in the
development of Seismic Safety Elements and other seismic related projects. One respondent's
reason for using private consultants was expressed in this way:

"[Consulting firms] have more expertise then we do here. We are a small community. We
don't have much staff to speak of, so we have to rely on those folks that have that kind of
expertise."

Since local officials assume that these private consultants will incorporate appropriate
information into the documents that they produce, it is not surprising that there are few primary
users of earth science information within these Southern California jurisdictions.

Other studies highlight the importance of staff geologists and private consultants in using
and implementing seismic and geologic hazard information. Spangle Associates (1993:4) found
that "the work of staff geologists and consulting geologists serving local government is critical to
successful local use of earthquake hazard information." In fact, these researchers assert that
having geological expertise available to staff is one of the most important factors in jurisdictional
use of earth science information. Hayes (1988b) also found that county geologists contribute
significantly to hazard reduction activities. These researchers, however, have not pointed to the
critical role that emergency managers play in the use of earth science information in local
governments.

Emergency management personnel were also identified in this study as primary users of
earth science information in a majority of the jurisdictions under analysis. Given their important
role in public education and emergency planning, emergency management personnel reported
using planning scenarios and general fault and epicenter maps. These personnel especially
highlighted the importance of planning scenarios as planning and education tools. In general, then, staff geologists, emergency management personnel, and private consultants are the primary users of earth science information in the local governments studied. A consequence of the reliance on a few primary users is a diffusion of responsibility among local officials.

**Diffusion of Responsibility**

A diffusion of responsibility in the use of earth science information characterized all the cities and counties under analysis. Most respondents felt that the use of earth science information is the responsibility of planning departments or, in Counties A and B, the counties' geologists. For example, one respondent stated that "in terms of decision making, when [the geologist] tells me we have a problem, I listen [to him]...he has a lot of credibility." County A and B respondents correctly assume that staff geologists are incorporating earth science information in their work. However, the geologists indicated that other departments within their respective counties are just now beginning to fully utilize their expertise and knowledge.

Respondents' assumption about the role of planning departments in the use of geological data is often misguided. In many cases, members of planning departments are not extensively using earth science information, indicating a lack of communication within the jurisdictions about who is using this type of information. A negative consequence of the lack of communication associated with the compartmentalization of governmental roles is the low proportional use of earth science information by city and county officials.
Respondents identified several features of earth science publications that affect the use and usefulness of these materials. These include the type of document, the manner in which the document is written, and the scope of the document. Consistent with Spangle Associates (1993), maps and planning scenarios were found to be particularly useful. Many respondents indicated that planning scenarios are effective planning tools because they collate "a lot of information into one concise report" and are easy to understand. Many emergency management personnel reported using these scenarios for conducting emergency exercises and developing emergency plans. The planning scenarios are also good public education tools as illustrated by the comment that they "provide an excellent means for us to portray in layman's terms a threat...that would impact people."

Maps of fault zones and past damaging earthquakes, as well as other earthquake related hazards (e.g., liquefaction zones), were also considered very useful by many respondents. Like planning scenarios, maps are good educational tools. Officials like maps because "everyone can relate to maps" and they raise public curiosity about hazards. Respondents' use of Alquist-Priolo (A-P) Special Studies Zones maps illustrates this point. Although developed to meet the guidelines established in the A-P Act, many respondents find these maps useful for public education and personal reference.

The manner in which earth science publications are written was also found to affect their use and usefulness. Aside from staff geologists, many respondents complained that the information contained in such publications is too technical to understand, making it difficult for them to incorporate this information into their decision making. One respondent expressed this
difficulty by saying, "I'm not a scientist so if something is technical, of course it kind of limits it's useability." An emergency manager asserted that:

"There's no doubt about the importance of scientific babble. It's just a matter of trying to understand it, that's the problem. I never ever doubt their work because without them we'd be lost. But on the other hand, we need to understand; and the bottom line is, 'you don't talk in technical terms to a layman'."

Indeed, most respondents cited the need for some sort of translating body to reproduce these documents in a readable, policy-relevant form. For instance, one respondent asserted:

"I think there is value in having an intervening level that would allow a very technical and detailed report or document to be interpreted...and translated...into more useful terms and a useful context for emergency planners."

The limited use of overly technical reports is supported by a number of other studies (Spangle Associates 1993; Hayes 1988a; Reitherman and Leeds 1991).

Another factor related to the lack of utilization of earth science materials is their regional scope. This complaint was made by many respondents who feel the information is too broad and general for making local decisions on seismic and geologic hazards. For instance, one official stated,

"The more localized you can make [the information] the better off you're going to be. [The authors of these publications] have a tendency to talk in broad terms."

Another respondent asserted that "the more localized, the more useful [the information] becomes, especially at the local government level."
The finding that local officials prefer jurisdiction-specific information is consistent with other research on this issue (Spangle Associates 1993; Reitherman and Leeds 1991). Moreover, the involvement of local personnel in the development of this information is crucial (Havelock 1969; Glaser et al. 1983; Yin and Moore 1985; Hayes 1988a; Reitherman and Leeds 1991). The failure to involve local personnel in the development of jurisdiction-specific information can lead to local officials' distrust of the information, evidenced by an emergency manager's statement that:

"The conclusions that Mines and Geology drew in the '82 report are very dated. There are a number of factual errors in the conclusion phase, relating to infrastructure. For example, ...they had the locations of the fire stations wrong and they sometimes put too many fire stations in a community, too few fire stations in another community. You know those are glaring errors...which lead me to suspect that... there were similar errors in other areas."

**Accessibility of Documents**

For the most part, primary users have little difficulty accessing the earth science information they need. However, accessibility is more problematic for less frequent users of this information. To alleviate this problem, respondents offered several suggestions, including lists of available documents, a single organization responsible for disseminating earth science information, and Internet access to the information. For example, one respondent stated, "Just knowing where [the information] exists...would be helpful;" another said, "There needs to be someone to compile some type of list... telling us [what] publications... are coming out." Previous research has also documented the need for a central clearinghouse of earth science information (Spangle Associates, 1993; Hayes, 1988a).
State Mandates

State mandates were found to both facilitate or limit the direct utilization of earth science information by local officials. Utilization is facilitated when specific earth science documents are required for the implementation of a mandate. For example, successful implementation of the Alquist-Priolo Act requires the utilization of A-P fault zone maps produced by CDMG. Many city and county officials reported using A-P maps not only to meet the guidelines of the Act, but also for public education and personal reference. This is consistent with the Spangle Associates (1993: 22) finding that "maps with official status and attached to requirements, such as A-P maps, are almost always used over other information on the topic."

Conversely, utilization is limited when specific earth science materials are not required for the development and implementation of a state mandate, as is the case with seismic safety elements. Since the actual development of and the guidelines associated with seismic safety elements are not specified by the state and since private consultants are often hired to develop these documents, the need for local officials to directly utilize earth science information is minimized. As one planning official stated, "We feel that the information is already obtained and included in the documents that we work with."

Risk Perception

The perception that local officials have of the seismic risk in their area affects the utilization of earth science information.

Some officials are simply misinformed about the hazards threatening their community, illustrated by an official in City C who felt that the city "is relatively hazard-free." This is also the
case in City D where many of the respondents indicated that the seismic hazard is of little concern since they are unaware of any earthquake faults in the downtown area and the city contains no high-rise buildings. Yet many respondents spoke of a major earthquake that struck the area in the late 1970s, causing considerable damage to the county's administration building. Due to this low risk perception, these respondents felt that earth science information is of limited utility for local decision making.

Location of Jurisdiction

Finally, the relative lack of utilization of seismic and geologic information in City and County D, compared to the other jurisdictions, suggests that the rural or urban characterization of a community affects the use of earth science publications. Respondents from these two jurisdictions consistently cited the rural nature of their locale as a primary reason for not utilizing earth science publications in office decision making. One respondent who spoke about the rural nature of County D said:

"We don't have a lot of the problems that other communities have...although we're in a very active seismic area. We don't have the freeway over passes... We don't have tall structures in this area...We're not a densely populated area, there are a lot of open spaces around here."

Consequently, this official questioned the need for the utilization of earth science information in local decision making.
Chapter Summary

A number of interrelated factors were found to affect the use and usefulness of earth science materials, including: the primary users; the diffusion of responsibility; the nature of earth science documents; the accessibility of materials; the influence of state mandates; respondents' perceptions of risk; and the characterization of a community as either rural or urban.

Among the officials interviewed, emergency managers and staff geologists were identified as the primary users of earth science information. Officials' reliance on these primary users, as well as private consultants, results in a diffusion of responsibility and subsequent lack of utilization of earth science information.

Several factors related to the nature of documents affect the utility of earth science information. Certain types of publications, specifically maps and planning scenarios, are rated most favorably. Further, officials prefer localized hazard information presented in a non-technical manner. According to many respondents, the accessibility of earth science documents could be enhanced by creating a central clearinghouse for this information and making it available on the Internet.

Some officials do not directly utilize earth science information because they believe that it has been incorporated into state mandated documents produced by private consultants. The lack of utilization is further affected by some respondents' low perceptions of seismic and geologic risks, as evidenced by officials in City C and County D. Finally, the data suggest that the characterization of a community as either rural or urban may impact the utilization of earth science information.
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Havelock, R.G

Hayes, W. W. (ed.)

Hayes, W. W. (ed.)
Hirose, Hirotada

Mileti, Dennis S. and Colleen Fitzpatrick


Mader, G.L.

Mileti, Dennis S. and Paul W. O'Brien

Mileti, Dennis S., Colleen Fitzpatrick, and Barbara C. Farhar


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Moore, Gwendolyn B. and Robert K. Yin


Nigg, Joanne M.


Nigg, Joanne M., Alvin H. Mushkatel, and Richard C. Moore


Reitherman, R. and D. J. Leeds

Southern California Earthquake Preparedness Project

Spangle Associates
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Tierney, Kathleen J.

Turner, Ralph, Joanne M. Nigg, and Denise Heller Paz

U. S. Geological Survey

Wyner, A.J. and D.E. Mann

Yin, Robert K. and Gregory D. Andranovich

Yin, Robert K. and Gwendolyn B. Moore


Yong, Chen
APPENDIX A
March 2, 1995

Dear :

The Disaster Research Center (DRC) is currently conducting a study in San Bernardino, Orange, Riverside, and Imperial Counties and in the largest cities in those counties. The study, which is funded by the United States Geological Survey, focuses on how cities and counties use scientific information about earthquake and other geologic hazards in their seismic safety planning, emergency management, and risk management activities. Examples of the types of scientific information the study focuses on include hazard maps, fault maps, earthquake planning scenarios, and similar materials. The study also seeks to determine what organizations and information sources local communities find most useful in their earthquake risk management activities.

As part of this project, DRC staff members will be in Southern California during the last week in March to interview officials in key city and county agencies about these topics. Among those we plan to interview are chief administrative officers, risk managers, planners, directors of building and safety, emergency managers, public works officials, and staff geologists. I am writing at this time to request your participation in this study.

One of our staff members will contact your office during the week of March 13 to answer any questions you might have about the study and to make arrangements for an interview. If you believe that there is someone else in your office who can provide more detailed information on how your agency uses material on seismic and geologic hazards, let the staff member know at that time, and we will make arrangements to talk with that person.

Please note that in keeping with Federal requirements and our Center's longstanding policies, statements made in interviews are kept confidential. We do not release the names of those we interview or attribute statements made in interviews to particular individuals. The purpose of this project is to understand how local communities use scientific data, in order to improve the process of information transfer to local governments; it is not our objective to evaluate in any way the performance of local officials or agencies.

Please feel free to contact me at the telephone number listed on this letter if you have any questions about this request.

Sincerely yours,

Kathleen Tierney
Associate Professor, Sociology
Research Director, Disaster Research Center
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<thead>
<tr>
<th>No.</th>
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<th>Title</th>
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<td>16</td>
<td>OFR 84-106</td>
<td>Preliminary Slip-Rate Table and Map of Late-Quaternary Faults of California. Lienkaemper, M.M. et al. 1984. Map scale: 1:1,000,000</td>
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<td>20</td>
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<td>Recent Reverse Faulting in the Transverse Ranges, California.</td>
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Maps Showing Recently Active Breaks Along Various Faults in Southern California.

APPENDIX C
USE OF EARTH SCIENCE INFORMATION
BY LOCAL GOVERNMENTS IN SOUTHERN CALIFORNIA

INTERVIEWEE: ____________________________

TITLE: ________________________________

ADDRESS: ______________________________

DATE & TIME OF INTERVIEW: _________________

INTERVIEWER: ____________________________

(Attach interviewee's card here)
CONFIDENTIALITY STATEMENT

TO BE READ--ON TAPE--TO EACH INTERVIEWEE PRIOR TO BEGINNING THE INTERVIEW. INTERVIEWEE MUST ACKNOWLEDGE WILLINGNESS TO BE INTERVIEWED.

Before we begin this interview, (Mr./Ms. ____________), the University of Delaware requires that I get your consent to conduct this interview. Your participation is, of course, voluntary; and all information you provide will be confidential. Any information we use from this interview will remain anonymous and will not be connected with you in any way. You may, of course, decline to answer any question we ask or to discontinue the interview at any time. Do I have your consent to continue this interview?
In this interview, we are going to be discussing several topics, including how government agencies and policymakers in (NAME OF CITY OR COUNTY) use maps, geologic reports, and other scientific information on geologic and seismic hazards and on earthquake impacts and how useful and important such scientific information is for your work.

SECTION A. FOR ALL INTERVIEWEES

1. Let's start with specific reports and other scientific information about the earthquake hazard and potential impacts in (name of city or county). Please refer to the copy of the list we mailed to you last week. (PROVIDE COPY FOR INTERVIEWEE IF HE/SHE DOES NOT HAVE ONE.) Which of the reports on the list are you aware of? That is, which ones does your office have?

(WRITE NUMBERS OF ALL REPORTS INTERVIEWEE HAS ON CHECKLIST A.)

2. Does your office have other reports or other types of scientific information on earthquake and other geologic hazards and on earthquake impacts that are not on this list, and, if so, can you give me the names of those reports?

(ADD NAMES OF OTHER REPORTS TO LIST ON CHECKLIST A. MAKE SURE YOU OBTAIN CORRECT, ACCURATE INFORMATION ON TITLES OF REPORTS, MAPS, ETC.)

3. Now, going back over the list of reports (maps, etc.) you've just identified, can you tell me which of them your office has used in its activities, say in the past five years?

(INDIQUE WHICH REPORTS WERE USED ON CHECKLIST A)

(FOR EACH REPORT USED)

3a. How was the report (information) used by your office?
(Probe for specific projects, decisions, use in public awareness campaigns, etc.)

(DESCRIBE USES OF EACH REPORT ON CHECKLIST A)

3b. (FOR EACH REPORT USED) How useful was the report (information) to your office? Would you say it was very useful, useful, not very useful, or not useful at all?

(CIRCLE RESPONSE ON CHECKLIST A)
3c. Why do you say that?
(Probe for interviewee’s assessments of clarity, understandability, completeness, format, scale, etc.)

(RECORD ANSWER ON CHECKLIST A)

3d. How important was the report (information) as a factor in your office’s decisionmaking? Was it very important, important, not very important, or not important at all?

(CIRCLE RESPONSE ON CHECKLIST A)

3e. Why do you say that?
(Probe for relative importance of scientific information, compared with other factors that influenced decisionmaking.)

(RECORD ANSWER ON CHECKLIST A)

4. Next, I have another list I’d like you to look over. This list contains the names of organizations that your office might have been in touch with for various kinds of information on seismic and geologic hazards and on earthquake impacts in your (city/county). Please go down the list and tell me which of these organizations your office has been in contact with for information about the earthquake problem in the last five years. These contacts may have been initiated by those organizations or by your office.

(HAND LIST B TO INTERVIEWEE. WRITE NUMBERS OF EACH ORGANIZATION CONTACTED IN BLANK SPACE ON CHECKLIST B.)

5. Are there other organizations or individuals that are not on this list that are also sources of earthquake hazard information for your office?

(ADD NAMES OF ORGANIZATIONS AND INDIVIDUALS TO CHECKLIST B. MAKE SURE NAMES ARE CORRECTLY AND ACCURATELY RECORDED.)

(FOR EACH ORGANIZATION OR INDIVIDUAL LISTED ON CHECKLIST B)
5a. What type of earthquake hazard information did you receive from (NAME OF ORGANIZATION OR INDIVIDUAL)?

(Probe for details of what was obtained, titles of reports, training, interpretation of scientific information developed by others, etc.)

(WRITE NATURE OF INFORMATION NEXT TO ORGANIZATION OR INDIVIDUAL NAME ON CHECKLIST B)

5b. How was that information obtained?
(Probes: Interviewee's agency initiated contact, meeting, training program, etc.)

(INDICATE HOW INFORMATION OBTAINED ON CHECKLIST B)

5c. Did your organization use that information?

(CIRCLE APPROPRIATE RESPONSE ON CHECKLIST B)

5d. (IF NOT USED) Why wasn't it used? (Probe: Not what organization wanted, needed; hadn't found occasion to use it yet, etc.)

5e. (IF USED)

How did your organization use the information?
(Probe for specific uses of information.)

(RECORD INFORMATION ON CHECKLIST B)

5f. How useful was it? Was it very useful, useful, not very useful, or not useful at all?

(CIRCLE RESPONSE ON CHECKLIST B)

5g. Why do you say that?

(RECORD RESPONSE ON CHECKLIST B)

SECTION B. FOR ALL INTERVIEWEES EXCEPT EMERGENCY MANAGERS AND RISK MANAGERS. FOR EMERGENCY MANAGERS AND RISK MANAGERS, SKIP TO SECTION C, QUESTION 31.
Next, I have a series of questions on different ways information on seismic and geologic hazards and on earthquake impacts might be used in your city/county.

6. First, to what extent has information on seismic and geologic hazards been used in decisionmaking regarding land use, zoning, and related issues in (NAME OF CITY OR COUNTY) in the last five years? Can you describe some recent land use decisions in (NAME OF CITY OR COUNTY) in which hazard-related information played a role?

7. How important has seismic and geologic hazard information been in land use and zoning decisionmaking, compared with other considerations? Has it been very important, important, not very important, or not important at all?

   Very 4 3 2 1 Not at all

8. Why do you say that? (Probe for other factors that have more of an influence, reasons why scientific information has less impact.)

9. Have there been recent decisions regarding land use in which seismic hazard information has been particularly important, and if so, please describe those decisions and how the hazard information was used.

10. To what extent has information on seismic and geologic hazards been used in development and redevelopment decisionmaking in (NAME OF CITY OR COUNTY) in the last five years? Can you describe some recent development and redevelopment decisions in (NAME OF CITY OR COUNTY) in which hazard-related information has played a role?
11. How important has seismic and geologic hazard been in development and redevelopment decisionmaking, compared with other considerations? Has it been very important, important, not very important, or not important at all?

Very  4  3  2  1  Not at all

12. Why do you say that? (Probe for other important factors.)

13. Have there been any recent development or redevelopment decisions in which seismic hazard information has been particularly important, and if so, please describe these decisions and how the hazard information was used. (Probe: Any environmental impact reports? Any project reviews for specific development projects?)

14. To what extent has information on seismic and geologic hazards been used in decisionmaking regarding your city's/county's investments in public facilities, infrastructure, and public works in the last five years? Can you describe some recent public investment decisions in which hazard-related information has played a role?

15. How important has seismic and geologic hazard been in decisionmaking regarding public investments, compared with other considerations? Has it been very important, important, not very important, or not important at all?

Very  4  3  2  1  Not at all
16. Why do you say that? (Probe for other important factors.)

17. Have there been any decisions about public investment in buildings and infrastructure in which seismic hazard information has been particularly important, and if so, please describe these decisions and how the hazard information was used. (Probe: decisions about building, retrofitting public buildings, other public works and facilities.)

18. When was the seismic safety element of your jurisdiction's general plan first written?
   
   ______Year

19. When was it most recently updated?
   
   ______Year

20. What seismic hazards does the seismic safety element identify?

21. What organization or individual developed the seismic safety element? (Probe: Done by city/county staff? Done by consulting firm, university, etc.?)
22. What types of scientific information were used in developing and revising the seismic safety element?

(Request Copy of the Seismic Safety Element)

23. Does [NAME OF CITY OR COUNTY] have a program for hazardous buildings, such as old unreinforced masonry buildings?

( ) YES
( ) NO (SKIP TO QUESTION 26)

24. Can you briefly describe the program for me?
(Probe: Inventory of buildings only? Notification of owners? Retrofit/strengthening program for existing hazardous buildings? Get details of program and any supporting documentation.)

25. What scientific information on seismic and geologic hazards and on earthquake impacts, if any, was taken into account when that program was adopted, and how did it enter into the decisionmaking process?

26. What types of scientific information on seismic and geologic hazards and on earthquake impacts are particularly useful for the work done by your office?
27. Are there factors that limit the usefulness of scientific information for the type of work done by your office, and if so, what are they? (Probe: Have you had any problems in using this information?)

28. Is there scientific information on earthquake and seismic hazards and on earthquake impacts that you need for your work, but do not have?

29. In general, how important is scientific information on seismic hazards and earthquake impacts for the work done by your office? Is it very important, important, not very important, or not important at all?

Very  1  2  3  4  Not at all

30. And finally, how can scientific information be made more accessible and useful to your department and other similar departments?

TERMINATE INTERVIEW AT THIS POINT, AND THANK INTERVIEWEE
PART C. FOR EMERGENCY MANAGERS AND RISK MANAGERS

31. How is information on seismic and geologic hazards used in emergency management/risk management activities in (name of city or county)? (Probe: uses in hazard assessment, emergency preparedness planning, training, public education, insurance decisions, recovery planning.)

32. What types of scientific information on seismic and geologic hazards and on earthquake impacts are particularly useful for the work done by your office?

33. Are there factors that limit the usefulness of scientific information for the type of work done by your office, and if so, what are they? (Probe: Have you had any problems in using this information?)

34. Is there scientific information on earthquake and seismic hazards and on earthquake impacts that you need for your work, but do not have?

35. In general, how important is scientific information on seismic hazards and earthquake impacts for the work done by your office? Is it very important, important, not very important, or not important at all?

   Very   1   2   3   4   Not at all

36. And finally, how can scientific information be made more accessible and useful to your department and other similar departments?

TERMINATE INTERVIEW AT THIS POINT, AND THANK INTERVIEWEE
ORGANIZATIONAL SOURCES OF INFORMATION ON EARTHQUAKE HAZARDS

1. Governor's Office of Emergency Services (OES)--includes Southern California Earthquake Preparedness Project (SCEPP), other OES offices

2. Southern California Earthquake Center--University of Southern California (SCEC)

3. United States Geological Survey (USGS)

4. California Division of Mines and Geology (CDMG)

5. Federal Emergency Management Agency (FEMA)--includes FEMA's National Emergency Training Center at Emmitsburg

6. Building Seismic Safety Council (BSSC)

7. California Seismic Safety Commission

8. California Institute of Technology (Caltech)


10. California Specialized Training Institute (CSTI)

11. University of California--Irvine

12. University of California--Riverside

13. University of California--San Diego

14. Other Universities (Which?)

15. Private Consultants and Consulting Firms (Which?)

16. California Department of Insurance

17. Newspapers (Which?)

18. Other Organizations and Individuals (Which?)
UTILIZATION AND IMPACT OF EARTH SCIENCE INFORMATION AMONG LOCAL BUSINESSES

Report Prepared by:

JoAnne DeRouen Darlington and Dennis S. Mileti

Natural Hazards Research and Applications Information Center
University of Colorado
Boulder, Colorado

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17 The authors wish to thank Eve Passerini for her data collection assistance.
USE OF EARTH SCIENCE INFORMATION BY CORPORATIONS IN SOUTHERN CALIFORNIA

Introduction

This research tries to get a sense of whether scientific information on the seismic hazard in Southern California is reaching firms for use by corporate decision makers. Do corporations in Orange, Riverside and San Bernardino counties use scientific information about seismic hazards when making decisions about land-use, development and/or redevelopment, and investment in facilities?

Methods

Corporations were selected using a database on publicly owned companies and contacts received from the San Bernardino County Office of Emergency Services. The Disclosure database has financial and management information on over 12,000 public companies. To be included, companies must meet the following criteria: 1) the corporation must have at least 500 shareholders; 2) the corporation must have at least five million dollars in assets; and 3) the corporation must have filed a 10K or 29F or appropriate registration statement with the Security and Exchange Commission in the last 18 months. The Disclosure database allows for the selection of corporations based on zip codes to establish locale. Size, measured by the number of employees, was the second factor used for selecting the corporations. Included were organizations with more than 100 employees located in the area at risk. The decision to include only organizations with more than 100 employees was based on previous studies that have
concluded that large organizations are better able to engage in planning (see Galbraith 1967).

Pfeffer and Salancik summarize the advantages of size:

Organizations that are large have more power and leverage over their environments. They
are more able to resist immediate pressures for change and, moreover, have more time in
which to recognize external threats and adapt to them. (1978:139)

Therefore, organizations with greater assets and with a large number of employees in the at risk
area would be more likely to engage in preparedness activities than organizations with limited
assets and few employees in the area at risk.

The Disclosure database provided a list of 230 corporations in Orange county and seven
corporations in Riverside county. Using the zip code and size criteria set above, the Disclosure
database did not list any corporations in the San Bernardino area. To obtain corporate contacts in
the region, the San Bernardino County Office of Emergency Services was asked to provide a list
of the largest employers in the county. The list contained 59 employers. Twenty-six of these
corporations were publically owned and had more than 100 employees in the San Bernardino
area.

Of the 263 corporations that met the criteria for use in the study, 169 were rejected for
having fewer that 100 employees. Although listed as employing more than 100 people,
information on the number of employees obtained by telephoning the corporation indicated
otherwise. Ninety-four corporations remained as potential interviews; 69 were located in Orange
county, five in Riverside county and 20 in San Bernardino county.

When phoning corporate offices, we asked to speak with "the person in your office or
department that is most familiar with the ways in which earth science information is being used in
your corporation." We were usually placed in contact with the corporate risk/emergency manager
or safety engineer. After explaining the purpose of the study we requested an interview. After making contact with the 94 corporations, we only managed to schedule eight interviews with corporations in the three counties. The most common reason for refusing an interview was that scientific information on hazards was not being used in corporate decision making (n=50). Other refusals included being too busy to participate, not having someone in the organization tasked with such responsibilities, leaving town, nothing to gain from the interview, and doing the job of two people. In two cases, information wasn't given out "for security reasons." In approximately 15 cases voice mail messages were left explaining the project and our desire for an interview but return phone calls were not received.

Because so few interviews were being scheduled, an alternative approach was undertaken. By driving around the city of Riverside, California, we located several corporate offices. Upon entering the building, the receptionist was asked how many employees were at this location. If there were fewer than 100, the receptionist was thanked and an interview was not pursued. If there were more than 100 employees, the receptionist was asked if there was a person in the office familiar with the ways in which earth science information was being used in the corporation. If there was, the study objectives were explained and an interview was requested. After being told of the study, three managers refused the interview. Another three agreed to be interviewed and are included in the study.

After conducting a few interviews with corporate spokespersons, an informant mentioned that seismic information such as that which we were inquiring about was provided to the corporation by a consultant. This insight revealed the need to investigate engineering and geologic consulting firms and their use of seismic hazard information in their work. The names of consulting firms were gathered using a snowball technique. The respondent referred to above
was asked the name of the consulting firm the corporation contacted as a source of information concerning the seismic and geologic risk in the area. This consulting firm agreed to a telephone interview and provided the names of two other firms considered "competitors" in the field. These firms agreed to answer questions concerning the use of seismic and geologic hazard information. These three consulting firms did not meet the selection criteria of the other corporations in this study, that is, they did not employ more than 100 persons.

From this purposive sample, 14 interviews were completed, three were with geologic consulting firms having fewer than 100 employees. These consulting firms work with engineered projects related to geologic exploration and minerals extraction. Each of these consulting firms had used information from the USGS to provide corporations with "information, guidance and recommendations" concerning seismic risk and safety, but agreed that "this type of consulting is not our bread and butter". The remaining 11 interviews included one grocery store chain with twenty separate facilities located in southern California, a business which distributes a full line of metal products, the manufacturer and distributor of mobile and stationary metal buildings, a firm responsible for designing, developing, manufacturing, marketing and servicing laboratory analytical instruments, a corporation that develops, manufactures and markets paper-based personal organizers for the retail market, a workers compensation provider, a hospital, a pharmaceutical company, a manufacturer of paper cups, and a computer software firm that designs, develops, markets and supports an integrated family of financial and management information software products. Excluding the consulting firms, the smallest corporation interviewed employed 320 persons, the largest employed 1800 persons in the southern California area.
The interview schedule contained the same questions used in the agency interviews, although slightly reworded to be relevant to the corporate spokesperson. These questions inquired about emergency preparedness activities taken by corporations, informative documents, organizational sources of information, the use of scientific information in various areas of decision making and how information can be more useful.

**Findings**

Respondents were asked how information they received is used in emergency management/risk management activities in their corporation. The responses varied considerably (see Table 1), with some corporations having performed some of the actions and others having done nothing. Preparedness activities included creating an emergency plan, investing in communications and utility backups, purchasing emergency kits, securing office furniture and equipment, employee training in first aid, CPR, search and rescue and employee education on evacuation routes and procedures for responding to an emergency or disaster.

**TABLE 1. EMERGENCY PREPAREDNESS ACTIVITIES TAKEN BY CORPORATIONS (N=14)**

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<th>Activity</th>
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<td>Training</td>
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<tr>
<td>Recovery Planning</td>
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<td>Evacuation</td>
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<td>Response Plans</td>
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<tr>
<td>Earthquake Kits and Supplies</td>
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Corporations have different rationales for stockpiling emergency supplies. One spokesperson said that "stockpiling raises employee moral and makes them feel as though the company cares about them." Also, after an earthquake, "the company may be on their own for the first 12 hours", implying that the organization would be responsible for its employees in the hours following the earthquake. Another respondent remarked that the corporation "encouraged employees to stockpile emergency supplies personally", thereby taking responsibility for their own safety. This particular company did not stockpile supplies believing that people will go home as soon as an earthquake happens, so there is no point having supplies at the office. Response and recovery planning were practically non-existent and not one of the corporations had earthquake insurance.

Companies that do any kind of extensive risk analysis hire outside consultants. The three consultants interviewed use information produced by USGS in their "recommendations" to clients. These respondents were not able to provide the titles of the documents produced by the USGS. The consultants stated that they provide information, guidance and recommendations, but all decisions are left to the corporate decision maker. Finally, the consultants remarked that they don't know the extent to which their recommendations get used.

None of the documents containing scientific information appearing on the list of publications were familiar to the corporate spokespersons or to the consultants interviewed. Four organizations were not in contact with any of the other organizations on the list provided (see Table 2). The corporations were most likely to contact the California Office of Emergency
TABLE 2. ORGANIZATIONAL SOURCES OF INFORMATION ON EARTHQUAKE HAZARDS (N=14)

<table>
<thead>
<tr>
<th>Source</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governor's Office of Emergency Services (OES)</td>
<td>6</td>
<td>43</td>
</tr>
<tr>
<td>Southern California Earthquake Center (SCEC)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>United States Geological Survey (USGS)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>California Division of Mines and Geology (CDMG)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Federal Emergency Management Agency (FEMA)</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Building Seismic Safety Council (BSSC)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>California Seismic Safety Commission</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>California Institute of Technology (Caltech)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Business and Industry Council for Emergency Planning and Preparedness (BICEPP)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>California Specialized Training Institute (CSTI)</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>University of California--Irvine</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>University of California--Riverside</td>
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</tr>
<tr>
<td>University of California--San Diego</td>
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<td>0</td>
</tr>
<tr>
<td>Other Universities</td>
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<td>0</td>
</tr>
<tr>
<td>Private Consultants and Consulting Firms</td>
<td>6</td>
<td>43</td>
</tr>
<tr>
<td>California Department of Insurance</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Newspapers</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Other organizations and individuals</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Services for information on earthquake preparedness, placing emphasis on issues of employee safety. Corporations also had contact with consulting firms when requesting seismic safety evaluations of facilities and also with firms promoting and selling preparedness activities such as securing of equipment with fasteners, survival kits, and flashlights.

The corporations included in this study were not making or have not recently made decisions concerning land use, development and/or redevelopment, or investments in facilities. Other factors that are more important than seismic hazard information when making land use decisions include market value of the property, cost, location and availability of the property. Land use decisions are also subject to the zoning laws of the community. Concerning investments
in facilities one respondent summed up the sentiment of many of the respondents when stating
that "worrying about risk assessment is not worth the time, money, or investment of personnel.
Economic considerations are given top priority."

When asked what scientific information would be most useful to corporate risk managers,
a hospital spokesperson stated the need for local level maps of faults zones and lifelines.
Respondents requested that information be specific and presented in plain language, void of
scientific jargon.

Conclusions

In conclusion, based on the information obtained from users in the private sector, scientific
information on seismic hazard and risk are not being used in corporate decisions relating to land
use, development and investments in facilities. When decisions requiring the use of geologic
hazard information are made, consultants are hired to investigate the issue and make
recommendations about the appropriate course of action. However, the extent to which such
recommendations are relied on for the making of a decision remains unknown.

One spokesperson offered the following statement at the conclusion of the interview
"...private decision making and implementation of hazard mitigation policy has tended to
focus on immediate benefits and has tended to ignore long-term costs that have resulted
from natural catastrophes...business as an economic entity acts to satisfy the demands of
the marketplace as a higher priority."
REFERENCES

Galbraith, John Kenneth

Pfeffer, Jeffrey and Gerald R. Salancik