COMMUNITY RESPONSE TO EARTHQUAKE THREAT IN SOUTHERN CALIFORNIA

Ralph H. Turner
Joanne M. Nigg
Denise Heller Paz
and
Barbara Shaw Young

PART TEN

SUMMARY AND RECOMMENDATIONS

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16. Abstract (Limit: 200 words)

This volume summarizes findings and presents recommendations of a study investigating individual and community response to earthquake threat in southern California. The overall objective is to provide a basis for understanding community response to earthquake predictions released to the public. Areas studied include (1) research design; (2) media response; (3) organizational response; (4) public awareness and concern; (5) action response of the public; (6) ethnic and racial differentials; (7) vulnerability zones and earthquake subcultures; (8) grass roots organizations and resistance; and (9) change and stability of the public's response. Recommendations deal with problems involving the media, public awareness, message credibility and comprehensibility, support for public action, and household and individual preferences. Policy recommendations include cultivating realistic public understanding; forming a network of intermediaries; making use of schools; working for vested interests in earthquake safety; establishing a comprehensive approach with population adjustments; and preparing for short-term earthquake warnings.

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Final technical report on National Science Foundation grants NSF ENV76-24154 and NSF-PFR78-23887, from 1976 to 1980, including preliminary work under US Geological Survey Grant 14-08-0001-G-347 in 1976. Any opinions, findings, conclusions, or recommendations are those of the authors and do not necessarily reflect the views of the Foundation or the Survey.

Ralph H. Turner--Principal Investigator
Joanne M. Nigg, Denise Heller Paz, and
Barbara Shaw Young--Co-Investigators

Institute for Social Science Research
University of California, Los Angeles
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THE REPORT

TABLE OF CONTENTS

Part Ten was written primarily by Ralph Turner, with direct help from Joanne Nigg and Denise Paz, drawing on the work of all the co-investigators and research associates on the project.

PART TEN
TABLE OF CONTENTS

FORWARD

This concluding volume of the technical report is intended to provide a brief summary of the findings from the nine preceding volumes and a set of recommendations inspired by the findings or by the process of conducting the investigation. The summary must necessarily be superficial, and we hope that it will be used chiefly to help readers find those parts of the detailed report that they can profit from reading. There is no way to extract a finite set of recommendations from the kind of broad analysis we have conducted here. Consequently we hope that our recommendations will be read as suggestive rather than definitive, and certainly not as exhaustive. Each reader will see practical implications that we have overlooked as he or she reads the findings against the background of a unique set of experiences and concerns.

For readers who want more detail on the survey findings about public awareness, understanding, concern, and action than is contained in this summary, but prefer a less technical and complete treatment than we offer in the earlier volumes of the technical report, we recommend our report entitled Earthquake Threat: The Human Response in Southern California, published in 1979 by the UCLA Institute for Social Science Research, and available from the National Technical Information Service. For information concerning the regular or microfiche versions, write: Document Sales, National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia, 22161. Refer to document number: PB 80 - 164732.

CHAPTER ONE

SUMMARY

Objectives and Research Design (Part One)

During the mid-1970's, glowing reports of successful earthquake predictions in the People's Republic of China and optimism over the prospects for prediction in the United States stimulated concern about the potential social and economic impact of a prediction announcement. Several efforts were made to anticipate what the effects would be by applying broadly based behavioral science knowledge to the question, or by posing hypothetical questions to key decision makers in the community. Although no announcement that qualifies as the "prediction" of a damaging earthquake has yet been issued for the United States, announcement of the southern California Uplift by the U.S. Geological Survey on February 13, 1976, provided the first opportunity to observe actual response to the near prediction of a damaging quake. The current investigation was conceived shortly after this date as a study of the public response to this potentially disturbing release.

If the complexities of earthquake dynamics make it unlikely in the foreseeable future that long- and medium-term predictions will be issued with precision as to time and place or a high degree of certainty, announcement of the Uplift may be a faithful prototype for future predictive releases. Hence the response in southern California should supply highly relevant clues to the impact of long- and medium- term earthquake forecasts in the future.

Events in the real world do not occur in the splendid isolation that would permit us to identify the specific linkages between cause and effect confidently. Announcement of the Uplift came just nine days after the devastating Guatemala earthquake that attracted great attention locally, especially among the large Latin population. There soon followed disastrous earthquakes in northern Italy, Indonesia, China, the Philippines, Iran, and Turkey, making 1976 an exceptional year for earthquake loss around the world. We cannot say whether response to the Uplift would have been different had the announcement come in relatively quieter 1975 or 1977.

Announcement of the Uplift was followed two months later by a very much qualified prediction for a potentially damaging quake in Los Angeles within a year, issued by Dr. James Whitcomb from prestigious California Institute of Technology. And in November Henry Minturn, who falsely identified himself as a credentialled seismologist, predicted an earthquake for Los Angeles on December 20 of the same year. Again, the effects of these forecasts cannot be sorted out from the effects of the Uplift announcement. In this case, however, multiple and reinforcing announcements are likely to follow any significant earthquake forecast, so their effects do not necessarily distort our findings.

Research objectives. The specific research objectives can be summarized as follows:

1) To describe and assess popular reception and understanding of reports dealing with the southern California Uplift and earthquake risk in the region, and what they imply for action by the populace, including awareness

of events, salience of concern, fear and anxiety, and understanding in scientific and nonscientific terms;

2) To describe and assess what people believe about safety and danger in case of an earthquake, about the possibility of saving lives and protecting property in the event of a serious earthquake, what steps they have taken themselves or contemplate taking, and public attitude toward the release of predictions and near predictions;

3) To describe and assess the extent of altruistic concern for the prospective victims of earthquake disaster, so as to guage public willingness to make personal sacrifices in support of hazard reduction programs;

4) To describe and assess what people believe their public leaders are doing to prepare for an earthquake and to clarify the meaning of events, what confidence they have in scientists and public leaders concerned with these matters, and their disposition to cooperate in hazard-reduction measures;

5) To describe and assess the steps by which individuals make up their minds on the foregoing matters, including sources of information and confirmation and the roles of the media and personal discussion;

6) To identify relationships between each of the foregoing considerations and proximity to prior earthquake disaster locations, living under especially vulnerable conditions, living in an ethnically or racially segregated neighborhood, levels of education and socioeconomic status;

7) To identify trends in popular reception and understanding, dispositions toward action, disposition toward collaborative response and altruism,

and choice among sources for information and confirmation for a period of two to three years after the initial forecast;

8) To note any unusual economic activity that might signal an economic response to earthquake prediction or near prediction;

9) To record and interpret the sequence of decisions and steps taken by public and private agencies concerned with public safety and planning, relating these to developing events, popular response, political pressures, and economic developments;

10) To record and interpret treatment of the earthquake threat in the media of mass communications and through other symoblic indicators of awareness and interpretation;

11) To examine the relationship to individual response of such items as past experience with earthquakes, commitment to the neighborhood and community of present residence and work, time perspective in which personal plans are being made, personal responsibility for the fate of family members and others, and degree of isolation or integration into meaningful social units.

If significant progress toward achievement of these research objectives is made, we should be able to offer recommendations on strategies for formulating and issuing earthquake announcements, steps to increase public readiness for an earthquake, the design of public programs for earthquake hazard reduction so as to respect the needs and concerns of the public, strategies for involving citizenry in planning and execution of hazard reduction programs, and special requirements posed by the situations and attitudes of minority groups.

Research design. The research design includes four different kinds of investigation, namely: a record and analysis of media coverage for the three years of 1976, 1977, and 1978; a record of key governmental and organizational responses; a series of sample surveys of Los Angeles County residents; and focused field research into grass roots responses.

Media analysis rested largely on complete monitoring of all items dealing with earthquake topics in six newspapers for three years, supplemented by more selective monitoring of television, radio, and magazines. The principal result is a detailed narrative that provides the definitive record of events as they were conveyed to the public. In addition, through content analysis we have reported the rise and decline of various themes and emphases in media treatment of the earthquake threat. Part Two presents this essential background for the study of public response.

Organizational analysis is the briefest and least thorough part of the investigation, since we were concerned with organizational response chiefly as it helped to shape public response. Because of the crucial role that schools might play in public awareness and preparedness and the apparant inaction by schools, a more intensive investigation of school response was undertaken in 1979 and is reported along with the organizational study in Part Three.

Survey research commanded most of our time, energy, and expenditure. The survey research consists of four separate studies making use of six different surveys.

The basic field survey consisted of at-home interviews with a representative sample of 1450 adult residents of Los Angeles County. The principal findings concerning awareness, understanding, concern, and action are derived from this set of data, and are reported in Parts Four and Five.

Special samples of people living in potential dam inundation areas, in zones with high concentrations of pre-1934 buildings, and in the zone of destructive impact for the 1971 San Fernando earthquake were extracted from the basic field survey and supplemented as necessary by additional interviews conducted at the same time for comparative analysis. Similarly, special samples of Blacks and Mexican Americans were constituted. In both instances the special samples were compared with control groups drawn from the basic field survey. These analyses are reported in Parts Six and Seven.

A panel design was used to constitute four waves of follow-up interviews at approximately five-month intervals after the basic field survey, in order to examine patterns of change and stability of response. These interviews were conducted by telephone and included both new subjects and reinterviewed subjects.

It was part of the research design to be prepared for contingencies that could have substantial effects on public response if they occurred during the study period. Questionnaires for use in telephone interviewing were prepared, pretested, and printed in sufficient copies for almost instant use in case of a destructive earthquake, a substantial but nondestructive quake, the authoritative cancellation or downgrading of warnings concerning the short-term earthquake threat, the authoritative issuance of a true prediction or a dramatic intensification of the warning based on the Uplift, and the disconfirmation

of a credible prediction by failure of the quake to occur during the specified interval. Only the substantial but nondestructive earthquake contingency occurred, on New Year's Day of 1979, and the scheduled telephone survey was completed before the month's end. The panel study and the New Year's Day quake study are reported in Part Nine.

Focussed field research involved a more flexible procedure for locating subjects and interviewing them in order to study spontaneous group responses to the earthquake threat. Findings concerning information seeking, neighborhood earthquake preparedness groups, and collective resistence to implementation of earthquake hazard reduction programs are presented in Part Eight.

Utilization. A detailed report of steps taken to facilitate the dissemination and utilization of findings from the investigation is included in Part One, and will not be recapitulated here.

The Media Response (Part Two)

In order to assess public response to the earthquake threat, we must first know something of the frequency and character of the earthquake messages communicated to the public through the mass media. Total monitoring of the hundreds of television and radio stations and newspapers and magazines in the Los Angeles area was obviously not feasible. But all earthquake-related items in the two major metropolitan dailies, three large-circulation community papers, and the major Spanish-language daily for 1976, 1977, and 1978 were identified and read. Most television and radio specials and magazine articles

were noted and monitored, and major network news broadcasts were followed fairly regularly. All items were classified by topic as either reports of current earthquakes, predictions and warnings concerning future earthquakes, personal and household preparedness for earthquakes, issues of earthquake safety, or some combination of these four categories.

News about current earthquakes commanded the most media attention and items on personal preparedness the least. Besides extended coverage of disastrous earthquakes, from the Guatemala quake of February 4, 1976, to the Iranian disaster of September, 1978, inconspicously located brief items reporting small earthquakes appeared every few days. Although coverage of earthquakes and earthquake prediction and warning was much higher in 1976 than in the subsequent years, no week passed without some attention to earthquake topics.

Main line media treatment, with one notable exception to be reviewed later, fell within the canons of responsible journalism, and was slanted toward support of the scientific and technological "earthquake establishment." The reality of the earthquake threat was generally unquestioned, and discussions took maximum responsible estimates of damage and injury as their point of reference. While playing Paul Revere in warning the public of credible and even certain disaster, the media tried to be reassuring, as if trying to avert panic and demoralization. The result was a frequent pattern in which an article or report began with a dire warning and ended with reassurances about the safety of most California homes or assertions that no immediate drastic action was called for. It is unclear to what extent the reassurance undermined the impact of the warning messages.

Except for the mature and analytic reports by the Los Angeles Times science editor, media reports generally fostered only limited comprehension of the earthquake situation. Especially with the oral media, successive items were highly repetitive, each starting from the beginning as if the listener had heard nothing previously. As a consequence, few reports progressed beyond a set of elementary facts and propositions. Reports were not so much cumulative as reaffirmative, little being said in 1978 that wasn't said in 1976. Authority and example rather than explanation were the rule. Also working against promoting public comprehension was a tendency to leave developing stories unfinished when events made them no longer newsworthy. The media generally ignored Dr. Whitcomb's withdrawal of his qualified prediction, and passage of the date for Henry Minturn's predicted earthquake and the period covered by the Soviet scientist's near prediction.

The most significant news items were reported by all the media, except that the Spanish-language daily featured the Guatemala earthquake of 1976 (but not the Mexico earthquake of 1978), while almost completely ignoring the earthquake threat in southern California. The community paper serving the site of the 1971 San Fernando earthquake featured quake preparedness and editorialized for dam inspection and evacuation planning. The leading metropolitan daily featured outstanding analyses in depth and campaigned editorially for action concerning existing unsafe structures. Otherwise, differences in coverage among newspapers seemed more accidental than systematic.

The leading media generally ignored earthquake forecasts by mystics and uncredentialled persons, though these were extensively aired elsewhere.

But one notable exception occurred in the case of Henry Minturn, whose forecast was featured on television. While the newspapers were generally critical of Minturn's forecast, attention to earthquake preparedness and safety was increased at the same time, perhaps lending indirect credibility to the currency of the earthquake danger. We cannot confidently identify the basis for the attention given to Minturn. But by using other announcements for comparison, we can suggest circumstances that determine how much attention an announcement will receive.

Announcement of the Uplift in February, 1976, intially received only limited attention. Two months later came a much greater surge of attention to earthquake prediction, combining the Uplift and the new prediction by Dr. Whitcomb. After a sudden decline in attention, predictions received only sporadic mention for eight months until the great surge of attention to Minturn. Again the decline was abrupt, and no prediction news was the subject of sustained attention throughout the next two years. Some combination from the following list of variables may explain the pattern of attention.

1) One key may be authentication by a source regarded as authoritative. The U.S. Geological Survey, which announced the Uplift, was not well known to the southern California public, while Cal Tech was. Whitcomb's association with Cal Tech and the almost simultaneous endorsement of the Uplift danger by the California Seismic Safety Commision supplied double authentication in April. Coverage dropped when the latter body failed to endorse Whitcomb's prediction. Once authenticated by NBC, Minturn's credibility was established in the eyes of many people. He was often

confused with Whitcomb and identified as a Cal Tech professor by members of the public. The later forecast by a Soviet scientist was disparaged by Cal Tech spokesmen, and was largely ignored.

2) Another key may be specificity of time and place and immediacy of the forecasted event. This criterion would explain the greatest attention to Minturn and the least immediate attention to the Uplift, but not continuing attention to the Uplift or the lack of interest in the Soviet prediction.

3) Personalization of the announcement may contribute to newsworthiness. The anonymous U.S. Geological Survey remained impersonal, as did the remote figure of a Soviet scientist, while Whitcomb and Minturn emerged as interesting human beings. Similarly, the fact that the report of a mini-quake swarm was made by a young woman seismologist contributed a significant component of human interest to it.

4) Cumulative effect may be important. The Uplift came as a new and unfamiliar idea. The idea of a predicted earthquake began to sink in when reinforced by Whitcomb. Receptivity to Minturn may have been fostered by the earlier announcements. However, no new predictions surfaced thereafter to test the possibility of further accumulation until the Soviet prediction in 1978, so there is no test of continuing accumulation. However the persistent questioning in the case of each new development in the Uplift concerning whether it signified an imminent quake suggests that a positive response might have revealed the hypothesized cumulative effect.

In light of the last observation, it is well to note that media officials may have interests at variance from public wishes. A deliberate media down-pedalling of attention to earthquake prediction news after Minturn appears to reflect both a desire by embarrassed news executives to avoid another comparable fiasco, and heightened concern for supposed dangers of false alarms. The latter was fostered by the much publicised findings of Haas and Miletti that an earthquake prediction could provoke an economic recession in the targeted region. Evidence we report later shows that the public remained hungry for new information about the earthquake danger during this period of time.

Although it stirred only ripples of concern when first announced, the Uplift remained newsworthy throughout the three-year study period, and became the stable reference point for all discussions of the earthquake prospect, earthquake preparedness, and seismic safety. Persisting newsworthiness may have been facilitated by the image of a tangible and continuing condition. In contrast to Whitcomb's elusive measurement of the speed of shock waves, the bulge as a tangible condition remained. Second, the Uplift was made newsworthy by continuing developments--rising, shifting to the south, being convulsed by a swarm of mini-quakes. In this respect the Uplift was like the central figure in the plot of a detective mystery. Third, the potential significance of the Uplift continued to receive authentication from respected members of the scientific community. And fourth, the initial uncertainty and lack of an early and specific date prevented early foreclosure of interest in the Uplift.

The media found the Uplift useful as the orienting background for discussions of other earthquake topics. Thus as time passed, the Uplift was less often discussed as a topic in its own right, but principally discussed as a justification for safety measures, personal preparedness, or federal support for research into earthquake prediction.

Attention to earthquake preparedness and safety generally seems to be stimulated either by the report of an earthquake or a forecast, or by public announcement of an organizational activity. The point here is that attention to earthquake preparedness and safety seems to require some stimulus or justification other than the continuing earthquake prospect. But the topic of organizational preparedness is much more responsive than the topic of individual preparedness. Initial announcements of both the Uplift and Whitcomb's prediction gave rise to discussions of organizational preparedness measures, but individual and household preparedness received scant attention until ten months after the Uplift announcement. The difference seems to be that organizations had developed plans after the 1971 quake and these reports and continuing organizational programs could serve as the basis for statements geared to the new earthquake warnings, while no organization was responsible for developing plans for individual response. When statements on personal preparedness finally entered the media, they were the work of concerned laypersons.

The connection between discussions of preparedness or safety issues and the occurrence of earthquakes is largely limited to local rather than remote events. Thus the nearby Santa Barbara quake brings reminders of danger at home, while devastating earthquakes in Italy, China, and Iran remain objects of remote concern. This pattern may be partially a consequence of the separation of

editorial assignments, so that accounts of these latter events are either taken from wire service reports or written by reporters assigned to a foreign beat. In some instances, as with the earthquake in northern Italy, reports of a great foreign disaster may even preempt attention otherwise being given to the local earthquake situation.

The issue of what to do about seismically unsafe old buildings was also responsive to concern about specific predictive announcements. Indeed, the old-building issue was like a standard package that could be opened dramatically with authenticated facts and figures each time the specter of an earthquake was aired. It was also an issue on which newspapers were willing to take an editorial stand.

Recurring discussions of dam safety, the siting of nuclear power plants, and the construction of an LNG terminal followed quite a different pattern. Editorial writers were less willing to take stands on these issues, and they were not part of the usual discussion stimulated by announcement of an earthquake prediction or warning. While the old-building question was conceived as a local issue, the other safety issues appeared primarily as state or national political issues without direct local relevance. Concern about the earthquake safety of the projected Auburn Dam in northern California or earthquakes that may have been triggered by the filling of Oroville Dam did not stimulate discussion about the dozens of dams above heavily populated areas in Los Angeles County. Furthermore, these would have been controversial issues irrespective of the earthquake danger, so earthquake threat was a compounding rather than precipitating concern in each instance. Occurrence of an earthquake near to the controversial site

stimulated discussion of these safety issues, but otherwise these safety issues became news only when dramatic steps in the political plot unfolded.

The occurrence of media attention to preparedness and safety issues can be summarized as follows. 1) Predictive announcements and warnings and the occurrence of earthquakes nearby stimulated discussions of preparedness and safety only to the extent that prepackaged materials were available. 2) Prepackaged materials were available generally when an organization had interests at stake, so published accounts may have overstated the extent of public and private organizational earthquake preparedness. 3) Since no organization has a specific stake in individual and household earthquake preparedness, treatments of this topic appeared only after much delay, and they lack the sustained and cumulative nature of some other topics. 4) Earthquake preparedness news often lags behind the events that stimulate concern because of the period of time required for interested organizations to assimilate the event and respond to it. Continuity and recurrence of attention to earthquake issues are largely maintained because of the "organizational lag." 5) Attention to politicized controversies over dam, nuclear plant, and LNG terminal safety, while emphasizing earthquake danger, does not stimulate attention to preparedness and safety in the local community and therefore probably does not contribute toward public understanding of the local earthquake threat. 6) The concern and compassion aroused by disastrous earthquakes in foreign countries is not translated into attention to earthquake preparedness and safety in the local area, but remains focused on the distant scene.

Organizations and Schools (Part Three)

Organizations. Since our principal concern in this investigation is the public response to earthquake warnings, we have attempted only a cursory review of organizational response, as it might facilitate or inhibit public awareness and response. Besides ascertaining what part government and private organizations played in shaping public response, we asked whether earthquake planning was initiated or intensified as a result of the announcement of the Uplift and subsequent discussion of earthquake forecasts, and whether the direction of preparedness activities was altered as a result. Traditionally the more conspicuous organizational activities in public and private sectors have dealt with emergency response--after the earthquake strikes--rather than hazard mitigation to lessen the impact of future earthquakes. We sought to determine whether attention to the possibility of predicting earthquakes might have stimulated increased attention to hazard reduction activities.

Our most general observation is that most organizational representatives denied that announcement of the Uplift constituted a significant new element in the situation, requiring revision of existing plans and programs or initiation of new ones. In some cases programs had been initiated, revised, or augmented following the San Fernando earthquake of 1971, and these actions were deemed adequate in light of the new announcement. In other instances programs of longer standing were premised on the assumption that earthquakes will recur in southern California, and announcement of the Uplift was treated as merely a reaffirmation of that assumption. The typical response from organizational representatives was a positive assertion that current plans were adequate to meet

any anticipated quake. The County Sheriff's Department, Los Angeles City Police and Fire Departments, and the private sector American Red Cross all advised us that their standard emergency procedure would cover any problems presented by a damaging earthquake. Except for a possible increase in demand for already existing services, they did not feel that special plans were needed to handle a major earthquake.

The specter of the Uplift did provide ammunition for local governmental efforts to mitigate the hazard posed by seismically unsafe older buildings in Los Angeles, Burbank, Santa Monica, and some other communities, and may have contributed toward growing support for these efforts by local officials and the public. In other realms of public activity the Uplift was increasingly cited as making support for existing programs especially urgent. At most, however, the effect was to give a small boost to existing programs rather than to initiate comprehensive review.

When notable changes or increases in activity were recorded by local agencies, the stimulus was usually either heightened public demand for services or pressure from state agencies. The City of Los Angeles Civil Defense Office experienced a dramatic increase in demand for speakers and materials on earthquake safety soon after the Uplift and Whitcomb announcements, which they tried diligently to meet. There was no significant reassessment of the budgetary and personnel needs of the office so as to enable it to cultivate incipient grass roots interest and launch a program to enhance personal and household earthquake preparedness. Much of whatever opportunity may have been created by grass roots concern in 1976 and 1977 was lost by continuing business as usual.

Other agencies, such as police and fire departments, health care facilities, and public schools were compelled by state law or encouraged by state agencies to incorporate earthquake planning more fully into existing emergency plans. The tension here was between a local agency predilection toward business as usual and the external pressures from the State of California.

While business as usual prevailed locally in the short run, the second and third years after the Uplift was announced witnessed more conspicuous attention to earthquake emergency preparedness, but not hazard mitigation, by a wide range of public agencies. After a delay of approximately one year, the Mayor of Los Angeles appointed a Task Force on Earthquake Prediction. The Report, completed and released after another twenty months, was more of the prolegomena than a plan, but did signal officially the obligation of city agencies to plan for a more specific earthquake warning.

The principal external stimulus for local activity came from the California State Office of Emergency Services and the Seismic Safety Commission. In both instances announcement of the Uplift provided the occasion for intensifying and diversifying programs that had their inception in the aftermath of the San Fernando earthquake. By initiating legislation, by applying direct moral pressure, by publicizing earthquake safety issues, by providing techincal assistance, and by initiating cooperative planning activities, these state agencies were back of most of the heightened local agency attention to earthquake preparedness. The fact that the Seismic Safety Commission in April, 1976, officially declared the southern California Uplift "a possible threat to public safety in the greater Los Angeles metropolitan area" was undoubtedly critical

in the gradual acceptance by local agencies of the proposition that more than a business-as-usual response was called for, and in sustained attention to the Uplift by the media and continuing public awareness.

We are reminded of the difficulty in sustaining preparedness activities for a disaster agent like earthquakes that recurs in damaging proportions only at intervals of several years in a given location. For organizations, this means that attention to earthquake preparedness must be fitted into organizational priorities and routines that have been designed for dealing with more pressing and shorter-term problems. An agency like the Seismic Safety Commission concerned only with matters of seismic safety may be the essential catalyst.

Schools. Except for the scattered responses of individual teachers and officials, the public schools did not initiate programs or intensify vigilance on the basis of the Uplift. However, in compliance with a new provision of the California Administrative Code, school districts and individual schools were required to file disaster plans and take other steps in preparation for an earthquake. Instructions to individual school districts from the County Superintendent of Schools stressed the threat posed by the Uplift as the occasion meriting careful attention to earthquake planning. Characteristically, the order provoked a flurry of activity to comply with a fall, 1977, deadline, but the plans were then filed in the Superintendent's office without being reviewed and, except for semiannual drills, the Code was deemed to have been complied with. Except where individual teachers, principals, or parents were personally concerned, little else was done.

There have been scattered local program success stories, although many of these have been ephemeral because their continuance depended on the dedication of single individuals. A critical element in the most successful program we located was that it evolved early from a school plan to a total community plan, and that several people developed personal stakes in its continuing success. Elsewhere schools were little better prepared for an earthquake three years after announcement of the Uplift than they had been before. Several problems have been highlighted to explain this limited accomplishment.

First, the external stimulus to action is a weak ordinance, vague in its requirements and easily satisfied by token compliance. Interpretative guidelines are minimal and there is no provision for review and evaluation or periodic revision of plans. Second, plans prepared in isolation and without community collaboration often make unrealistic assumptions about the continued availability of community services and the integrity of lifeline systems in case of a disastrous earthquake, ignoring the necessity for self-sufficiency and the state of isolation with which schools may have to cope. Third, many plans are premised on receiving support from an effective civil defense agency, while civil defense officials are the first to admit that civil defense exists only in token proportions.

Fourth, teachers are generally untrained for responsibilities they are supposed to shoulder, such as administering first aid, and in other respects their responsibilities remain vague and unspecified. Fifth, terminology and procedures for use in an emergency have not been standardized. The best known procedures are survivals from World War II and civil defense practices immediately thereafter,

with ambiguous meanings for current disaster situations.

Sixth, there are neither systematic provisions nor adequate support systems for training children to understand and deal with earthquake hazards at school, at home, and in the community. Seventh, clear understandings have not been reached between school personnel and parents concerning their respective responsibilities and authority in crisis. In the absence of legalized and widely advertized understandings, school plans will be thrown into disarray by the uncoordinated and imperative efforts of parents to reach and take charge of their children.

Finally, no apparant attention has been given to the possibility of responding to short-term earthquake warnings.

Again, earthquake planning has received as much and as conscientious attention in the schools as might be expected for a low-priority mandate in an overmandated system. But current plans are unlikely to measure up to the demands of a real emergency until schools have the incentive, the technical assistance, and the resources to plan for all realistic contingencies, and until school disaster planning becomes part of an integrated mutual disaster planning enterprise with the larger community.

Awareness and Concern in the Public (Part Four)

Parts Four and Five are based principally on the basic field survey of 1450 adult residents in Los Angeles County, conducted during January to March of 1977, with occasional use of items from the follow-up survey.

Attitude toward science. Since the general question for investigation is response to a scientifically based earthquake prediction or near prediction, we must first ascertain how people view science and scientists. First, the overwhelming respect for the potential of science is documented when five out of six respondents are convinced that scientists will be able to predict earthquakes fairly accurately in the future, while two out of five express an unrealistic faith in the present scientific capability for predicting earthquakes. Most people assign admirable motives to scientists and very few believe that scientists withhold information from the public in pursuit of their own self interest. Nevertheless, the population divides more evenly over the question of whether scientists always live up to their own standards and over whether science breaks down people's ideas of right and wrong. So the high respect for science does not preclude ambivalence about the actual effects of scientific advancement on the quality of life.

When reflecting on earthquakes, most people think in naturalistic rather than magical or mystical terms. But the choice among naturalistic causes suggests that the naturalistic perspective is tainted by moralistic assumptions and a view that it is dangerous to interfere with nature. And many people believe that scientists are not the only persons who can reliably forecast earthquakes. A critical question, then, is whether the population is polarized into a pro-scientific bloc and a large anti-scientific bloc dedicated to a religious or secular mystical world view. In fact, this is not the case. The general rule is the coexistence of science and nonscience, with the majority of people believing in both scientific and nonscientific grounds for forecasting

earthquakes. In part this pattern reflects the adoption of modern scientific perspectives without abandoning traditional folk beliefs, and in part it is a manifestation of populist thought, which respects the enterprising amateur as a worthy competitor to the professional and takes ones own intuitions and understandings seriously.

Finally, there is little evidence of conflict between science and religion in the earthquake realm. It is the secular mystics rather than religious mystics who today offer an alternative to scientific prediction of earthquakes.

Where people hear about earthquake danger and safety. Television, newspapers, and radio, in that order, are the most frequent sources that people acknowledge for information about earthquakes. When we ask for a single most important source of information about predictions and warning announcements, television leads all other sources combined. (This finding changes over time, as we shall see later.) Two out of five have read about earthquakes in magazines, and a small but significant number rely principally on other people as their information source. Typically people learn about earthquakes from a variety of sources, and this diversity is most pronounced among men, the young, Anglos rather than Blacks or Mexican Americans, the well educated, and those from higher-income households.

Most people had discussed the earthquake threat with someone, and the range of discussion partners varied in much the same way as the range of media sources, except that women's discussion patterns ranged more widely than men's. Given the opportunity, people most often had discussions with adults in their own households, friends and neighbors, and coworkers, in that

order. Even when children were present in the household, they were seldom incorporated into these discussions. Surprisingly, the more practical issues of family preparedness and earthquake safety are less frequent topics for discussion than actual earthquakes and predictions. Since this ordering of topics corresponds to the pattern of attention given to different topics by the mass media, it may reflect the media's "agenda-setting" effect on public discourse. Public opinion research has underlined the importance of "local experts" and "opinion leaders" in helping people interpret what they learn from the media. Among our respondents, those who number someone especially knowledgeable about earthquakes among their friends and acquaintances show high levels of earthquake awareness. But fully seven out of eight have no such local expert to turn to, which may be an important clue to limited earthquake awareness, understanding, and action among the people.

So far as earthquake topics are concerned, about two thirds of our respondents exhibit the classical pattern of getting information from the mass media and then sifting it through interpersonal discussion. But a quarter of the people rely exclusively on the media, while about one person in eleven relies exclusively or disproportionately on discussion.

Awareness of the Uplift. By the time that our basic field survey was conducted, the Uplift--better known as the Palmdale Bulge--had been a repeated topic for media attention for a full year. Nevertheless, fewer than one person in twelve mentioned it when asked about "predictions, statements, or warnings about earthquakes in the southern California area." When quizzed directly about the "bulge," about three out of five people had heard of it. But many

of these people did not realize that the bulge had anything to do with a possible future earthquake, so we must say that only 43 percent had heard of the Uplift and understood its import. And even this number is further reduced if we count only the 25 percent who thought there would be damage where they lived in case of an Uplift-related quake. Only one in four had heard and understood the message and saw it as personally relevant. As could be expected, people who expressed faith in scientific prediction capability were much more likely than others to take the Uplift seriously as the sign of a coming quake, whether they also believed in nonscientific forecasting or not.

A multiple regression analysis of correlates of awareness of the Uplift indicated that being older, being better educated, engaging in earthquake discussion with a wide range of partners, getting earthquake information from several media sources, and believing in scientific earthquake prediction capability contributed most directly to the extent of awareness and understanding of the Uplift. Having personal experience with earthquakes, having a high household income, and being female contributed indirectly to awareness. At least two findings could be surprising. First, discovery that young adults are less in touch with this key earthquake development than older adults runs contrary to earlier evidence concerning disaster threats in other communities, and may indicate that universal exposure to television combined with more free time is reversing the historic isolation of the elderly. Second, respondents who live in households with school children are possibly less aware of the Uplift than other adults, indicating that school children are not serving as messengers to alert their families to the earthquake threat as they have done

for fire safety and other matters of emergency preparedness.

There are some contradictory effects. Some groups of people who are less likely to have heard and understood the significance of the Uplift are more likely to see its personal relevance when they have heard. These include women, persons from lower-income households, and Mexican Americans.

The predictions, forecasts, and warning messages people remember. Word of the Uplift was but one of many kinds of earthquake warning announcements conveyed to the public. Nearly seven out of eight people could remember hearing at least one such announcement and a sizable minority had heard two or more. But few individuals remembered more than that. Nearly half the announcements reported were vague and general in character, or merged quite different types. Of the references that were specific enough to be identified, the majority referred to Henry Minturn, whom many identified as a scientist. The forecast that California would fall into the sea, a variety of forecasts by secular clairvoyants, the Uplift, and James Whitcomb's prediction, in that order, received from six to four percent mention. There are affinities between particular kinds of announcement and information sources: television is especially prominent as the source for the vague general warnings, newspapers for scientific announcements, radio and "people" for pseudoscientific announcements, and books and magazines for prophetic announcements.

A multiple-regression analysis of the correlates of number of predictive and warning announcements remembered was conducted, similarly to the analysis for awareness of the Uplift. Again, engaging in earthquake discussion with a range of partners and getting information from several media sources contributed to remembering more than one announcement. But neither believing in scientific

prediction nor being older are relevant, and the correlation with education is much weaker. On the other hand, having experienced personal earthquake loss contributes both directly and indirectly to remembering more than one announcement. Here we are apparantly measuring a more diffuse sensitivity to earthquake warning information in contrast to the more discriminating sensitivity measured by awareness of the Uplift.

Taking earthquake messages seriously. Of the many announcements that people remember, less than a third are taken seriously, even though most are remembered as referring to potentially destructive quakes. Only about 30 percent of the people could remember one or more announcements concerning a destructive announcement that they took seriously. While earthquake forebodings are "in the air," they remain ethereal for the majority and are simplified to a single forecast or warning for most of the rest.

Taking announcements seriously is fostered by discussion but not by media use. Fear and concern over earthquakes, which did not help to explain awareness of the Uplift or number of predictions heard, emerges as the strongest correlate of taking announcements seriously. Although the relationship is weaker, fatalistic attitude toward earthquake threat works against taking announcements seriously. Age works indirectly against taking announcements seriously, while being female, having experience with earthquakes, and being well educated contribute indirectly toward taking announcements seriously. The indirect effects of race and ethnicity are contradictory. Thus we see new elements entering to make the difference between merely remembering announcements and taking them seriously. Fear of earthquakes and belief in the possibility of acting to reduce earthquake danger are the key variables.

When we compare types of announcements, scientific announcements are most often taken seriously, but they are least often thought to refer to earthquakes of high intensity. The latter finding parallels the earlier observation that the qualifications and reassurances that typically accompany scientific announcements may lull people into an unwarranted sense of security.

The credibility of announcements also differs strikingly according to the chief source of information. Although books and magazines rank low in the hierarchy of information sources, many more of the announcements gleaned from them are taken seriously. It seems likely that if prophetic announcements were not so often reported in books and magazines, they might have very little credibility. The credibility of television and newspapers is quite similar, but substantially less than books and magazines. Radio credibility is less, and "people" as an information source is least credible. This last observation suggests that people can distinguish between rumor and authenticated information, and that the power of the media is not fully diluted by the sifting of information through discussion in face-to-face groups. Apparantly the printed word is not necessarily more potent than the spoken word. But the pattern of treatment in depth and the less transitory nature of magazines and books seems to enhance their credibility substantially.

Expecting an earthquake. Asked about the likelihood of a damaging earthquake in southern California within the next year, forty three percent thought there probably or definitely would be such a quake, and only a very few felt there definitely would not be. It is clear that the forty three percent have drawn conclusions that go beyond what is justified by the views of the scientific community as they have been conveyed in the mass media. Newcomers

to the region are more likely than long-time residents to expect a damaging quake within a year, but people who have experienced more than one damaging quake are more disposed to expect another soon. Awareness of the Uplift and remembering announcements contribute to expectation, but not so strongly as the number of announcements taken seriously. It is striking that many people who do not remember any warning about a damaging earthquake that they take seriously nevertheless expect a damaging earthquake within the year. And people who combine media as information sources with discussion are more likely to expect a damaging quake within the year than people who rely exclusively on the media or disproportionately on discussion.

In a regression analysis, earthquake fear and concern is the most important correlate of expecting a damaging quake soon. And the number of announcements remembered makes a substantial additional contribution. But the evidence suggests that people hold definite and imminent expectations of a damaging earthquake because of inadequate understanding rather than sound appreciation of science. Both confidence in scientific prediction capability and favorability toward science are negatively related to earthquake expectation. Educational attainment and household income are weakly but negatively related to expectation.

Perhaps three additional observations are justified. First, the substantial positive relationship between fear and expectation contradicts a widespread assumption that fear of earthquakes is handled by denial. Second, the unjustified definiteness and imminence of the expectation indicates what can happen when people are presented with information that they lack the background to

interpret correctly. And finally, the early expectation of a damaging earthquake may owe as much to nonscientific forecasts as to scientific announcements.

Fear and concern about earthquakes. Thus far in examining awareness we have neglected emotion--the intense fear that earthquakes evoke in many people. First we found that very few people are sufficiently preoccupied with the earthquake threat to mention it spontaneously when asked about problems facing southern California residents or the hazards of life in the region. Problems such as crime, cost of living, taxes, unemployment, smog and pollution, transportation, crowding, and education and busing come to people's minds before they think of earthquake danger. But when asked directly about earthquakes, most people admit being frightened and about half admit being worried. The possibility of mass flight is raised when three out of ten people say they would try to be as far away as possible in the event of an earthquake, though experience elsewhere suggests that most of these respondents would not actually act on such an impulse in the event of a confirmed prediction. About three out of ten respondents believe that their concern about a coming damaging earthquake increased during the preceding year, but the majority say their level of concern remained unchanged. Thus if we can credit our respondents' self perceptions, the Uplift, Whitcomb's "prediction," and Minturn's forecast have had lasting emotional effects on only a substantial minority of the region's population.

The level of fear and concern and the sense of recently increased concern are higher for people who experienced damage or loss in a past earthquake, for those who engaged in discussion of earthquake topics rather than relying

exclusively on the media, for those who remembered more than the average number of predictive and warning announcements, and for those who were high on awareness and relevance of the Uplift. But fear and concern are more strongly correlated with the number of announcements taken seriously than the number remembered, and much more strongly correlated with the fear experienced during previous earthquakes. Thus while earthquake warnings and past earthquake experience have some effect on level of fear, the emotional response to earthquakes may be chiefly a matter of individual personality and therefore immune to gross changes in response to levels of public discussion of the earthquake threat.

The most tangible expression of intense fear would be the determination to leave the area. Just under a quarter of the respondents say they have discussed "moving out" with someone, but since few of these discussions were with other family members we conclude that in most cases discussion had generally not yet reached the serious decision-taking level. In separate questioning we asked people whether they were likely to move away during the next five years, and of those who might move only ten (out of 1450) mentioned earthquakes as a possible reason.

Do people want to hear about earthquakes? It is often said that Californians have a head-in-the sand attitude toward the earthquake threat, and that they are quickly sated with information about earthquake predictions and earthquake preparedness. A year after the original survey we asked respondents about media coverage of five earthquake topics. From 65 to 83 percent wanted more coverage of "the Palmdale bulge and scientific earthquake prediction," "what to do when an earthquake strikes," "how to prepare for an earthquake," and "what government officials are doing to prepare for an earthquake."

No more than three percent thought there had been too much coverage of any of these topics. Only the topic of "earthquake predictions by people who are not scientists" had received too much media attention according to 43 percent, though fully a quarter of the respondents felt even this topic had not been aired enough.

While people overwhelmingly want more rather than less information about earthquake preparedness and prediction, there is more ambivalence about the public release of uncertain predictions. Nearly everyone favors release of a nearly certain prediction, though a substantial minority would wait until closer to the predicted date. But the majority do not favor releasing a prediction when scientists can only assign a probability of 50 percent to occurrence of the quake.

A favorable attitude toward releasing earthquake predictions is associated with favorable attitudes toward science, not suspecting that scientists are withholding information out of self interest, expecting a damaging earthquake during the next year, higher than average fear and concern, and taking one or more prediction and warning announcements seriously. We reach two important general conclusions. First, there is no evidence here that the prevalent levels of fear lead to denial: the more frightened are even more positive about the release of predictions than the less frightened. Second, the three forecast-warnings of 1976 have not produced the classic false-alarm disillusionment effect. Instead, people who took seriously one or more of these announcements are more likely than other people to favor the public release of earthquake predictions.

Finally, while one person in four sees release of predictions as strictly the scientists' responsibility, the majority feel that some or all of the responsibility for such judgments should rest with government officials.

Action Response in the Public (Part Five)

Continuing examination of data from the 1977 field survey, we ask in Part Five to what extent the levels of awareness and concern reviewed in Part Four can be converted into a disposition to act or to support action by public officials and others.

What can be done? There is a good deal of fatalism about earthquakes, ranging from three out of five respondents agreeing that "earthquakes are going to cause widespread loss of life and property whether we prepare for them or not," to about one third endorsing the statement, "The way I look at it nothing is going to help if there were an earthquake." People are less fatalistic about the possibility of taking steps to protect themselves than they are about the general impact of an earthquake. The highly fatalistic are less often aware of the Uplift and express less fear of earthquakes than others do.

It is important to understand whether people think of earthquake disaster in individualistic terms--every person or family for themselves--or as requiring collaborative action in the community. We assume that an altruistic response is most likely if (a) people are aware of groups in exceptional danger, (b) their awareness is personal rather than impersonal, (c) they believe something can be done for those in great danger, and (d) they feel that responsibility extends beyond the immediate circle of family and friends. Five out of eight respondents recognized that some groups were in greater danger than others. But twice as many mentioned people subject to impersonal environmental conditions (such as

inhabitants of old buildings) as mentioned personal attributes (such as the elderly and the handicapped). A few mentioned groups to which they belonged, but membership in a threatened group had a sensitizing effect so that these people also mentioned more than their share of other groups subject to special danger. Three quarters of the people who mentioned endangered groups felt there was something to be done for them, apparantly contradicting the finding of widespread fatalism when we shift from expression of a general attitude to addressing specific groups of people and situations. But people who belonged to one of the especially endangered groups were less optimistic than others about being able to reduce risk. And more people thought something could be done for endangered groups identified by personal attributes than thought people subject to unusual environmental threat could be protected. Public responsibility for protective action was accepted for all groups, though more for personal-attribute than environmental-condition groups.

Combining several measures we find that the prevailing tendency is to see preparing for an earthquake as requiring collective rather than merely individual and family action. Government is the overwhelming choice as the appropriate agency for collective response. The conditions that would facilitate an altruistic response in case of emergency are generally present, except that endangered groups are more often identified in impersonal rather than personal terms.

What should government be doing? If people look to government to deal with earthquake hazard, have they thought about what government should be doing. Nine out of ten respondents were able to volunteer at least one suggested activity

for government, and two thirds of the people offered two or more suggestions. Suggestions for upgrading unsafe structures, public education, and planning for emergency care and relief, in that order, constituted seven eighths of the suggestions. The emphasis is on immediately and obviously practical steps, with very few suggesting more support for research or improved earthquake prediction, and even fewer references to making earthquake insurance more readily available. It is striking, however, that more of the suggestions deal with hazard reduction than with emergency response preparedness--an encouraging sign that people appreciate the less well publicized side of disaster preparedness. Generally people who saw the Uplift as personally relevant, who remembered and took seriously more than the average number of predictive and warning announcements, and who placed themselves in especially endangered groups offered the widest range of suggestions for government action.

We were only weakly successful in identifying correlates of support for collective action to deal with earthquake threat. Surprisingly, neither prior earthquake experience nor any of our communication variables was relevant. Not being fatalistic, favoring the release of predictions, believing in both scientific and nonscientific grounds for earthquake forecasting, and being highly educated all contributed directly toward support for collective action. Being young, being Mexican American, not being Black, and not living in the San Fernando earthquake impact zone all contributed indirectly to a collective-action orientation. We were considerably more successful in explaining number of suggestions for government action. Not being fatalistic, remembering more than the average number of predictive announcements, being aware of more than the average number of endangered groups, and having some idea of why earthquakes occur were the substantial direct correlates. Having

personal earthquake damage experience and being well educated had substantial indirect effects, though again, communication variables were unrelated in the final analysis. It is clear from these two analyses that dispositions toward action are different from awareness of earthquake threat. Mere awareness is not enough to insure either understanding of the need for collective action or thoughtful consideration of potential steps for government officials to take.

Six months after the basic survey we asked a sample of 977 residents of Los Angeles County what should be done about "buildings that engineers say are likely to collapse in a strong earthquake." Surprisingly, in light of organized resistance to action in Los Angeles and other city councils, 41 percent favored closing the unsafe buildings down until they could be made safe, and another 47 percent favored posting signs warning people of danger in case of an earthquake. Responses differ little as applied to apartment buildings, places of work, churches, theaters, and stores. A slight majority place responsibility for paying the costs of upgrading unsafe structures on the owners and occupants, but a substantial minority expect government to pay some or all of the cost. Whether people use unsafe buildings themselves makes no difference in how they answer any of these questions, except that people who frequent several types of unsafe structures may be slightly more disposed to expect government to help with the costs of upgrading than people who frequent fewer such structures.

There is less public consensus over dam safety and fault zone safety. Just over half favor draining unsafe dams immediately and just under half would definitely not buy a house in an active fault zone, but fully a quarter in each

case would willingly take their chances. Quite similar percentages opposed and favored building the proposed Liquid Natural Gas Terminal at Point Conception in spite of documented earthquake risk.

Does public support for a wide range of government actions persist when questions of cost and taxes are raised? Ninety and eighty percent of the people, respectively, said it was important for government to invest large amounts of money in enforcing building codes and providing loans to strengthen unsafe structures. Sixty-five and fifty-eight percent respectively felt similarly about spending on systems for issuing predictions and for prediction studies. Support for government spending for the first two purposes is so nearly consensual that meaningful analysis of correlates was not feasible. Support for the two kinds of prediction expenditures was directly associated with belief in both scientific and nonscientific prediction, belief in strictly scientific prediction, fear and concern over earthquakes, and a favorable attitude toward the public release of earthquake predictions. Being aware of endangered groups and being young contribute indirectly to support for government spending. Sex, race, and earthquake experience have contradictory indirect effects. The prime determinants -- belief in earthquake prediction and support for release of predictions -- resemble the determinants for number of suggestions for government action, but earthquake fear and concern enter the picture while fatalism and number of predictive announcements remembered drop out, as does level of education.

Only when we raise the question of priorities do we find less than overwhelming support for government expenditure to reduce earthquake hazard. Given the choice, more than twice as many people would spend to improve public education, improve police protection, and improve public hospitals and health care as would choose earthquake hazard reduction. Earthquake hazard reduction takes priority over improving flood control by a slim margin and over improving parks and recreational facilities by nearly two to one. As could reasonably be anticipated, people who remember and take seriously more than the average number of predictive announcements and people who expect a damaging earthquake within the year assign the highest priorities to earthquake hazard reduction.

The largest segment of our sample endorse the noncommittal evaluation that government officials are "doing an average job" in dealing with earthquake preparedness problems. But three out of ten find government doing a poor job, while only two out of ten say government is doing a good job. This negative evaluation is especially prevalent among those who understand the earthquake threat best and have thought most about what government should be doing, so it is an evaluation that gains in credibility because of the people who make it. But when asked to compare levels of preparedness, respondents rate government preparedness above their own preparedness, and rate government and self much higher than general public preparedness. Thus we conclude that dissatisfaction with efforts to prepare for an earthquake applies to both the citizenry and their government, with a feeling that however inadequate government efforts have been, the people at large have done even less.

What have people done for themselves? A check list of sixteen frequently suggested steps that could be taken by householders in preparation for an earthquake was used as the basis for assessing individual preparedness. The most frequently endorsed measures, such as having a working flashlight and battery operated radio and a first aid kit, would be taken by prudent people for other reasons. Although we asked whether measures were taken for earthquake or other reasons, we cannot precisely distinguish earthquake preparedness from general preparedness. Except for the three items already mentioned, most respondents readily admitted that they had not taken most other steps. Few people had stored up water or food, taken precautions against objects falling out of cupboards, or participated in any cooperative neighborhood activity. In owner-occupied dwellings, one in eight claims to have purchased earthquake insurance, which is undoubtedly an exaggeration. In nearly half the households with children, efforts have been made to teach them what to do in case of an earthquake, but much smaller proportions have taken further steps in family planning for an earthquake. Household preparedness increases with age up to about fifty years, then declines.. Preparedness goes with high levels of education, having children in the household, attachment to the community, past experience with earthquakes, and awareness of the Uplift. Whether people considered their homes and their areas of residence relatively safe or unsafe made no difference in levels of preparedness. Expecting a damaging earthquake within a year is associated with higher preparedness. Fear and concern contribute to preparedness up to a point, but the most fearful fifth of the population have done less. This finding supports a common psychological principle that moderate fear is productive but that very high levels of fear can be counterproductive.

Level of personal preparedness is positively correlated with number of suggestions for government action and negatively correlated with evaluation of government actions, but unrelated to support for government expenditure.

In a comprehensive analysis, having discussed family preparedness is the strongest correlate of household preparedness, while personal earthquake damage experience, not being fatalistic, being attached to the community, learning about earthquakes from a wide range of media sources, and not being Black contribute directly but less strongly toward preparedness. Being younger, having school children in the household, having higher educational attainment, being Mexican American or White Anglo, and having experience with other disaster agents besides earthquakes all contribute indirectly to preparedness.

Ethnic and Racial Differentials (Part Six)

If public officials and others are to deal effectively with earthquake preparedness among the large Black and Mexican American populations of southern California, they must know whether these minority communities understand and deal with the earthquake threat differently from the White Anglo majority. Four broad features of the minority communities were examined as being particularly relevant. First, do these communities differ in the communication pattern by which they gain information and through which they confirm, interpret, weigh, and elaborate earthquake warnings? Second, do they differ in their support systems, i.e., the pattern of resources for help and collective action in the face of shared difficulties? Third, are there different customary

patterns for dealing with risk and uncertainty in these communities? And finally, are members' responses to earthquake threat likely to be affected by different prevailing attitudes toward the social and political establishment and to authority in general?

Samples of 292 Blacks and 188 Mexican Americans were compared with a control sample of White Anglos. Because the minority communities were younger and of lower socioeconomic status than the White Anglo community, on the average, statistical controls were used to partial out the effect of age, occupational status, household income, and educational attainment in comparing the three samples. We shall summarize the findings separately for Blacks and Mexican Americans.

The Black community. Compared with White Anglos of comparable age and socioeconomic status, Blacks begin the communication chain by using fewer media sources, by leaning more heavily on television with its relatively brief and superficial reports, and missing the indications of localized and racial relevance that would be gained by reading a community or "race" newspaper. At the second stage of communication, Blacks are strongly distinguished from White Anglos and Mexican Americans by their exclusive reliance on the media, without the benefit of discussion to sift the messages and sensitize the potential receivers of media communication. Accordingly it is not surprising that fewer Blacks are aware and appreciative of the southern California Uplift and that they remember fewer earthquake warning announcements. Nevertheless they do not differ from White Anglos in the proportion who expect a damaging earthquake within a year's time. Thus Blacks are equally likely to have assimilated the general message, but in more instances the earthquake anticipation

is divorced from any specific details concerning the grounds for the expectation or the time, place, or magnitude of the anticipated disaster.

If the family is the nucleus for most support systems, Black males are no more likely to live alone than White males of comparable age and socioeconomic status, while Black females are less likely than White females to live alone. However, there may be differences in the ready accessibility of the family unit as a support system. First, smaller percentages of young and middle-aged Blacks are married and have thereby institutionalized their claim to support from a family of procreation. Second, older children in Black households are seldom involved in discussions of earthquake topics, suggesting that they may be peripheral to the effective household social unit. Third, more of the Black households consist of just one adult female and one or more children. Assuming that children are usually less able to provide strong support in planning for disaster or coping with disaster than other adults, support might have to come disproportionately from outside the nuclear family, from an extended family network or from the community.

Blacks are more likely than White Anglos to have relatives living nearby, and they report more group involvements in the immediate vicinity, so they may have dual support linkages to the immediate community through both kinship networks and organizations. Of the three groups, Blacks assign religion the greatest importance in their lives. Concentration of over half the Black respondents in the Baptist denomination establishes the potential for a comprehensive integrating support unit in the community, and we suppose that the report of more local group involvements refers principally to church participation.

It is more difficult to judge whether these potentially available resources have actually been used in dealing with the current earthquake threat. Blacks are like White Anglos in seldom making family emergency or post-quake reunion plans and seldom engaging in neighborhood earthquake planning. But fewer adults in households with children have instructed them in what to do during an earthquake. Furthermore, fewer Blacks recognize or concern themselves about groups that are exceptionally vulnerable in case of earthquakes and who might require help from the community.

Looking at communication and support systems together, although Blacks have acquired the same sense of earthquake imminence as White Anglos, and have nuclear family, extended family, and church support systems that in balance may be as effective as White Anglo systems, the earthquake threat has not been equally incorporated into the communication and support systems of Blacks, and the groundwork development of social sensitivity necessary for involving Blacks into a community-wide earthquake support system has yet to be done.

Both Blacks and Mexican Americans seem to be less blasé than White Anglos about earthquakes. But Blacks admit to being more frightened of earthquakes they have already experienced than Mexican Americans, while the reverse is true of fear and concern about earthquakes in general and in the future. These differences can plausibly be interpreted as indicating that the strongest orientation among Blacks is toward the present and that future orientation is weaker. Although the evidence is mixed, Blacks in general are more skeptical about the possibility of foretelling the future, at least so far as earthquakes are concerned. They are just as likely as equivalently bracketed White Anglos

and Mexican Americans to overestimate the present ability of scientists to predict earthquakes, but fewer of them express confidence in the eventual achievement of accurate prediction and they are especially skeptical of foretelling earthquakes on the basis of unusual animal behavior. Blacks also express less faith in the possibilities of managing the future, as indicated by substantially more fatalistic attitudes. And they reject the idea of personal invulnerability more emphatically.

With this type of present time orientation, Blacks should not be especially concerned about earthquake prediction or dealing with earthquake hazard. But insofar as they are concerned they lean toward the use of nonscientific rather than scientific instrumentalities. The lesser concern about earthquake threat appears to be translated into less personal and household preparedness than is reported by equivalently bracketed White Anglos. This deficit might be attributed to lack of information, caused by restricted involvement in earthquake communication. But the low level of preparedness is more likely a symptom of a generally applicable weak future orientation and lack of faith in the manageability of the future.

One item that seems not to fit the general picture is the strong support by Blacks for spending large amounts of public money on building safety. But many of the old masonry buildings are concentrated in Black neighborhoods and the racial connection has been publicized in the political arena. The immediacy of this problem may have been sufficient to overcome the limited orientation to the future.

The less favorable attitudes toward science that we have described may be part of a more general attitude toward established groups and authority in society. Blacks are more likely than White Anglos of equivalent age and social stratum to believe that scientists and public officials are withholding information about earthquakes from the public. Blacks also less frequently favor giving the responsibility for releasing predictions exclusively to government officials. However, when Blacks are compared with equivalently bracketed White Anglos, they offer similar numbers of suggestions for government action and are no more negative in their evaluation of government efforts to reduce earthquake hazards. And when it comes to government spending for earthquake hazard reduction, they are more supportive.

These few findings suggest a widespread ambivalence toward government in the Black community. Blacks apparantly look toward government to deal with the problem of earthquake hazards. But at the same time they have reservations about trusting government officials fully. Their evaluations of government accomplishments are neither strongly positive nor strongly negative, suggesting a limited degree of personal engagement with the problems of government.

The Mexican American community. Communication is conditioned by the fact that Spanish is the principal language in about half the Mexican American homes. While many from Spanish-speaking homes read La Opinion, which gives a Latin American slant to the news and slights earthquake prediction and safety in southern California, English-language papers are also widely read. Mexican Americans may discuss earthquake prospects a little less frequently than their age and stratification counterparts, but the important difference is the greater

concentration of discussion of earthquake matters within the family. By observing that Mexican Americans do not name family members as authoritative sources for prediction information more often than other groups, we are assured that extended family discussion does not create a walled-in unit, but provides a rich setting for commentary on the media. The discussion of earthquake topics is primarily among adults and older children, with younger children apparently either sheltered or not taken seriously as contributors to such discussions.

Fewer Mexican Americans than White Anglos have heard of the Uplift, but Mexican Americans probably take what they have heard more seriously, more often giving credit to predictive announcements and assuming that the Uplift means damage where they live. Taking warnings seriously is translated into more frequent expression of the conviction that a damaging earthquake is imminent. But the conviction is not necessarily rooted in remembering specific information: the number of Mexican Americans who expect a damaging earthquake within the year but could not recall a specific forecast or near prediction that they took seriously is disproportionately high.

The family is preeminent in the Mexican American's support system. Fewer Mexican Americans live alone, or in households with fewer than two adults. They marry younger and live in larger households, more often including school children. More of the households are economically self-sufficient as indicated by the presence of a wage earner, most commonly the male identified as household head. A traditionally constituted family household is more generally available to Mexican Americans than to either Blacks or White Anglos as the fulcrum for their support systems. In addition, they are more likely to have other relatives living nearby to whom they can turn than either Blacks or, especially,

White Anglos. While the availability of strong family support units is widespread, and families are important in sifting earthquake communication, specific earthquake support activities are equally common in Mexican American and White Anglo households.

Their common identification with the Catholic Church, coupled with assigning more importance to religion in their lives than White Anglos do, suggests an important source of support and integration as a group. Similarly, the existence of a well established Spanish-language newspaper that features items of special concern to the Latin community should contribute to integration in the ethnic community. However, readership of La Opinion by Mexican Americans whose principal household language is English is low. And identification with the Catholic Church is not translated into any unusual level of participation in locally based organized group activities, such as would be expected if the identification were more than symbolic. Hence while the Catholic Church affiliation and support for a Spanish language newspaper are important resources, their contributions to maintaining an integrated supportive ethnic community may be more potential and symbolic than active at the present time. We return to the extended family as probably the best documented support unit beyond the walls of the individual household.

Mexican Americans are neither more nor less disposed to appreciate the existence and needs of especially vulnerable groups of people. But the recognition of such groups is more often strictly altruistic among Mexican Americans than among White Anglos or Blacks, in the sense of referring to groups in which they do not include themselves. Informed and alerted to emergency needs,

the Mexican American ethnic community may contribute more than its share to support activities in the encompassing community.

The observation that Mexican Americans compared with Blacks express greater fear of earthquakes in general and in the future but remember being less frightened during earthquakes they have already experienced suggests a greater preoccupation with the future among Mexican Americans. They share with White Anglos a disposition to believe that the future is predictable and many express unjustifiable faith in the possibilities for prediction now. They seem to have greater faith than either Blacks or White Anglos in the manageability of the future as indicated by a lower level of fatalism about earthquake effects and a greater willingness to entertain the idea of personal invulnerability to earthquake effects. This combination of fear of future earthquakes and belief in manageability of the future is consistent with an ambivalence concerning the release of earthquake predictions.

Compared with White Anglos, Mexican Americans are a little less favorable toward science and a little more accepting of the folk belief of earthquake weather and in prophetic forecasts of earthquakes. Though Mexican Americans are no more nor less prepared for an earthquake in most respects than comparably placed White Anglos, they are strikingly less disposed than either Black or White Anglos to consider or use earthquake insurance as a device for dealing with earthquake threat.

In spite of close ties to their own national heritage, Mexican Americans look to American government officials to deal with earthquake hazard and have a more favorable view of official accomplishments than either White Anglos or Blacks.

And while their relatively low income and occupational status predispose them to support government spending, their level of support exceeds what would have been expected on these grounds.

The positive attitude toward government, though not the reliance on government, is the third major difference between Mexican Americans and Blacks. Combined with the greater availability of conventional nuclear and extended families as foci for communication and support systems and the disposition to view the future as both more predictable and more manageable, it underlines the extent to which minority groups so similar in their disadvantaged position in American society may exhibit contrasting social systems and orientations for dealing with shared risk and uncertainty.

Vulnerability Zones and Earthquake Subculture (Part Seven)

Throughout most of the investigation we have been asking questions about categories of individuals. For example, we have asked whether the elderly or the young are more aware of the earthquake hazard, whether Blacks, Mexican Americans, or White Anglos are more fatalistic about the prospect of suffering loss and injury from an earthquake. Now we turn to a different but related question: are there neighborhoods or zones where earthquake awareness, concern, and preparedness are higher than in the community at large? Is awareness heightened in neighborhoods where the risk from earthquakes is especially great? Is the earthquake threat a more vital concern to residents of neighborhoods that suffered damage in the most recent destructive earthquake?

In order to answer these questions we have identified four special zones. The inundation zone includes neighborhoods subject to flooding in case a dam should collapse in an earthquake. The zone of old buildings includes neighborhoods with the highest concentration of buildings constructed before 1934, when building codes were revised to meet stricter seismic safety standards. The combined hazard zone includes neighborhoods where both of the foregoing hazards apply. The San Fernando Earthquake Zone includes neighborhoods where there was extensive property damage or where the population was evacuated for several days at the time of the 1971 earthquake. Interview responses in these four zones have been compared with responses by a "control" population living in other parts of the community. Statistical methods have been used to eliminate response differences that could have been caused by the different age, socio-economic status, and racial or ethnic composition of the various zones.

Our first finding is that there are surprisingly few differences in awareness, concern, and preparedness among the zones. Living in a zone of heightened earthquake vulnerability or recent destructive earthquake experience has not affected the extent to which people are informed about recent predictive announcements, the amount of concern people feel over the earthquake threat, or the actions they have taken to improve their own survival chances.

A second finding is that people who live below dams have no sense of being subject to special risk in case of an earthquake. There is some evidence of distinctive awareness in each of the other zones, but none in the inundation zone. This finding lends further support to an earlier conclusion that preparing

people to deal with the possibility of dam failure is one of the most neglected aspects of earthquake preparedness.

A third finding is that living where old buildings are concentrated does sensitize people to their personal vulnerability. But when residents in the zone of old buildings think about what government can do, they are less likely to suggest efforts to strengthen existing structures and more likely to stress emergency preparedness. Their concern is that government should be ready to save lives after the quake and its resulting destruction occur! They are also more dubious about the desirability of releasing uncertain earthquake predictions. Sensitization to their vulnerability makes them less sanguine about hazard reduction efforts and more concerned about the aftermath of a quake. Although they are no better prepared for an earthquake than people in other zones, there are indications that they may be more predisposed to respond to public leadership at a time of publicly recognized urgency.

Fourth, residents in the San Fernando impact zone are like residents in the zone of old buildings in showing greater sensitization and possibly readiness to respond in a recognized emergency rather than reporting more activity to prepare self, family, and neighborhood. But to understand the significance of living in this zone we must distinguish between the effects of having personally experienced the quake-related destruction or evacuation and the effects of living in the area where longer-time residents remember these experiences.

Fifth, experiencing the earthquake in the damage or evacuation zones appears to have motivated people to pay closer attention to information dealing with earthquake danger and earthquake safety and to have thought more about what government should be doing in preparation for an earthquake.

But these effects are not diffused to residents of the same zones who came there after the earthquake. In that sense there is no "subculture" of heightened concern that suffuses the neighborhoods most affected by the most recent destructive earthquake.

However, our sixth finding is that living in the San Fernando earthquake zone has some effects irrespective of whether residents were there in 1971 to experience the quake directly. There is a heightened sense that one ought to be earthquake-prepared, similar to that found in the zone of old buildings, more support for government expenditure to improve prediction and warning systems (unlike the old buildings zone), and a sense of being members of an especially vulnerable group. These distinctive attitudes cannot be attributed to any unusual amount of discussion of earthquake topics among neighbors, but could be explained by the distinctive attention given earthquake topics in the Valley News.

A final observation must be stated as a very tentative interpretation rather than a finding. Although we find a limited range of distinctive attitudes in three of these four special zones, we find little evidence to support the conclusion that the attitudes are diffused and fostered by discussion among neighbors. A more plausible interpretation seems to be that earthquake hazard awareness is fairly evenly diffused throughout the County, and it is the generally shared awareness that identifies zones of special vulnerability and crisis history. People living in certain neighborhoods develop somewhat distinctive perspectives from the experience of living in zones to which the larger community assigns special earthquake significance, rather than learning them through neighborhood discussion. Thus the earthquake subculture pertains to the region as a whole

rather than to the special hazard and experience zones, and residents in these zones exhibit special sensitivity because they have accepted the scenarios defined as appropriate to their zone of residence by the regional subculture.

Grass Roots Organization and Resistance (Part Eight)

In part Eight we shift our attention in two respects. First, we ask to what extent the earthquake threat provokes public initiative, so that some community mobilization occurs without waiting for government to lead the way. Second, we look for evidence of grass roots collaboration in coping with the earthquake threat--people getting together to work on their common problem.

Information seeking. People do not always wait to see what is in the newspaper or hear what is on television and radio: they sometimes take the initiative in trying to get information and help that does not come to them routinely. People have learned to turn to different agencies for different kinds of information. Public libraries are used principally by students doing school projects on earthquakes and secondarily by people seeking the locations of faults near their residences or prospective residences. Requests are relatively infrequent and their number has not risen in response to the issuance of predictive announcements, except for a slight increase after the Minturn forecast and disconfirmation. Police and fire stations and California Institute of Technology receive a flurry of calls after each small tremor, as callers ask for confirmation that an earthquake has occurred and request details about the quake. People turn most often to Cal Tech, with its well

publicized local seismology laboratory, and less often to the more remote U.S. Geological Survey in Menlo Park, for confirmation and clarification of predictions, forecasts, and general warnings, whether they originate from scientists, psychics, or others. People seeking more immediately practical survival information are usually referred to the civil defense agency, such as the Los Angeles Civil Defense Office. Radio talk shows also serve as a medium for seeking and sharing information related to current announcements and concerns.

Information-seeking activities of all kinds responded very slowly to announcement of the Uplift but reached a peak after Dr. Whitcomb's April announcement. Activity then declined and followed an erratic course until October and early November when there was another peak. The highest peak came during late November and December while Minturn's forecast was active and a minor peak followed during the first few months of 1977, with attention shifting away from predictions and toward household preparedness and what steps were being taken by government agencies. Information requests from individuals respond most quickly to events, peaking early and then declining, while requests from organizations accumulate more slowly and build up to a peak later. The reasons for the peak of interest activity in early fall are obscure. Quite a few people wrote to the U.S.G.S. and the Seismic Safety Commission as suggested in earthquake survival leaflets distributed with telephone bills at this time. But the inquiries to Cal Tech and the Civil Defense Office were stimulated by persistent rumors that a destructive earthquake had been imminently predicted, usually giving Cal Tech as the source but sometimes citing a well known psychic.

Group meetings. From our surveys, from a list of requests for speakers received by the Los Angeles Civil Defense Office, and from newspaper notices

we were able to identify and follow up 135 groups that sponsored some sort of meeting or program about earthquakes. Very few meetings were arranged by previously unorganized neighborhood groups. Work groups holding sessions for employees accounted for the largest number of meetings, followed by civic, social, and service organizations and schools. Most of the meetings were devoted to practical problems of earthquake preparedness rather than to predictions and earthquake dynamics. Civic, social, and service organizations and schools did not "discover" earthquakes as a meeting topic until the time of Minturn's forecast, then continued to feature this topic through the first half of 1977, while other organizations started earlier. The peak period for meetings of all kinds came between January and April of 1977, a full year after first announcement of the Uplift and after the Whitcomb "prediction" was withdrawn and the Minturn forecast disconfirmed. Most groups sought outside experts as speakers, with Civil Defense employees being used most extensively. Meetings ranged in attendance from 15 to 400 persons. Most groups had only a single meeting devoted to earthquake topics. The most striking difference we observed between instances of short-lived and continuing activity was the presence of some person with special interest and knowledge who worked to keep group interest alive. In addition, discussion in continuing groups was more likely to go beyond immediate problems of personal preparedness to include problems of prediction.

In a substantial proportion of instances, meetings were held to satisfy some legal requirement imposed on the organization. Hospitals, schools, and work groups held meetings to develop emergency response plans or to acquaint employees and others involved in the organization with emergency plans. Once

these objectives were accomplished, interest in earthquake safety evaporated. In the case of service and civic clubs, there was often little concern beyond the need for a speaker at a regular meeting.

The specially motivated organizers who played crucial roles in promoting more extensive group activity typically had learned something about earthquakes or earthquake safety through other contacts, and also had heard concern about earthquakes expressed by members of their own group. Concern over the recent earthquake warnings and predictive announcements also played a significant part in most of these instances, with a peak period of activity from August to January, ahead of the peak period for more organizationally stimulated meetings. But even with a deeply motivated and informed catalyst these organizational activities were usually transitory. In competition with other opportunities, the meetings did not draw large attendance and the sponsors were disappointed. When activity centered on planning, the completed plans seemed to eliminate the reason for further activity. And when the activity centered on gathering information, available relevant and interesting information was soon exhausted.

Organizations that engaged in persistent activity and either modified their organizational structure to accommodate the earthquake interest or integrated it into significant ongoing programs were strictly those whose organizational goals were especially compatible with some aspect of the earthquake concern. The Mormon Church's theme of preparation for self sufficiency in an emergency made earthquake preparedness a continuing responsibility. Explorer Scouts already had a program featuring preparation for service in emergency situations, and ham radio and C.B. groups emphasized their function in establishing emergency communications in times of crisis. These groups had linkages to the appropriate authorities that could be activated during an earthquake as

well as in other crises.

Very few new groups were established because of the earthquake threat. The extremely small number of spontaneously created neighborhood groups concerned with family and neighborhood earthquake preparation did not survive beyond single meetings. One group spurred by the enthusiasm of a student organizer was active during two years at a high school. Other groups were shaped as extensions of the preexisting interests of their founders: a hobbyist established an earthquake prediction group using a simple "tiltmeter" he had constructed; a ham operator purchased a surplus tiltmeter from the government and attempted to involve other ham operators in prediction; a small group of home economists first saw the relevance of home dried food to earthquake survival, and then moved into full fledged consideration of earthquake preparedness, presenting packaged programs for civic groups and preparing a manual for use in the individual household. Only the last of these groups gave promise of making a continuing contribution, though limited resources or lack of professional promotion prevented their becoming a significant force in the community.

The most general conclusion from this review is that the events of 1976 did not produce significant and lasting neighborhood planning, and the only sustained organizational contributions to earthquake preparedness came from organizations for whom earthquake preparedness activities could be seen as a natural expression of a major organization goal.

The typical lag of several months between events that stimulated interest in earthquake prediction and preparedness and the scheduling of meetings by organizations had three types of causes. First, it was often attendance at one meeting that stirred some individual to set up a meeting in another organization

to which she or he belonged. Second, reliance on a limited pool of experts to serve as speakers often required delays of several weeks so as to fit into the speaker's schedules. Third, organizations typically plan their activities some time ahead, and certain periods, like the month of December, are traditionally preempted for seasonal programs. The resulting lag may have helped to keep alive the interest in earthquake preparedness after the sense of urgency had declined, but it also meant that most meetings were less well attended and less likely to stimulate follow-up activity than would have been the case had they occurred during the period of peak interest. It is also possible that the flurry of rumor activity during the fall and the receptivity to the unfounded forecast by Henry Minturn might not have occurred had organizations been able to respond more promptly to the peak of information-seeking activity in April.

Organizational resistance: the Los Angeles Building and Safety Ordinance. The most extensive and effective group responses to the earthquake threat were not efforts to prepare for an earthquake, but consisted of organized resistance to proposed hazard mitigation activities. The most widely publicized example was the continuing resistance to efforts in the city of Los Angeles to deal with the hazard posed by unreinforced masonry buildings. These buildings were constructed before codes were modified after the 1933 earthquake to include acceptable standards of seismic safety. The effort to devise and enact a suitable statute began after the 1971 San Fernando earthquake. In public hearings from March 1975 to January 1977 a series of proposed ordinances were presented, varying the number and types of buildings affected and the specific corrective actions required. Near the end of the process a proposal to post warning

signs outside unsafe buildings was included in the proposed legislation. Early in the process when public assembly buildings were the principal target, theater and church constituencies provided some of the most significant opposition, and charges of discriminatory treatment and claims of economic hardship were most prominent. In the final stages the most significant opposition was organized by an association of apartment house owners, supported by a Black councilman charging racism. Property owners viewed the legislation as confiscatory, and stress was placed on the loss of employment opportunities and increased housing costs in already economically depressed areas of the city. Throughout all debates the high cost to the owners of making required modifications was stressed, but several proposals to seek funding or tax incentives to relieve this burden produced no tangible results. During the debate the Building and Safety Commission shifted its position from demanding that buildings be brought up to current building code standards to a position that only modifications to insure acceptable seismic safety should be required. In the face of resistence and their own ambivalence, the City Council in early 1977 dropped the proposal to post warning signs and voted a two-year delay while a city-wide survey to identify unsafe buildings was conducted, environmental impact explored, financial assistance sought, and a new ordinance drafted.

Although some of the same opposition groups were once again mobilized, the City Council in January of 1981 finally enacted legislation requiring that unsafe structures be reinforced or demolished within three years after the date of official notification. Notification may not come for as long as four years in the case of buildings with fewer than 20 occupants. Residential buildings with less than five units are exempted entirely, and seismic safety

standards are substantially reduced from those applicable to new buildings. Time extensions of up to nine years are possible if less costly stopgap measures are taken during the interim, or in case of special hardship.

Sources of community resistence to earthquake hazard mitigation. Three cases of mobilized resistance to hazard mitigation efforts attracted our attention. Resistance to the Los Angeles Building and Safety Ordinance was largely orchestrated by well organized interest groups. Resistance to implementation of California's Alquist-Priolo Act in neighboring Ventura County was also orchestrated by interest groups, but mobilized considerable grass-roots support. Designation of an area along a newly identified "active" fault as a "special study zone" would have blocked or impeded three construction projects already in advanced stages of planning or construction. Resistance in the Mojave Desert town of Little Rock to a California State Department of Water Resources order to discontinue use of a dam directly upstream from the town corresponded most closely to a grass roots movement. The dam had for years provided the community with an independent water supply, but had been judged seismically unsafe. We sought to understand why grass roots support could be mobilized in each of these instances.

Several consistent differences in perspective between public officials and the affected public in these situations are critical. First, while public officials focus on the earthquake danger, resisters see the earthquake threat as but one evil in relation to many harmful consequences they anticipate from the mitigation action. Second, the destructive impact of an earthquake is only a possible--or at most a probable--evil, while deleterious consequences from the mitigation action are certain. Third, the scientific or technological framework employed by public officials is countered by a commonsense framework in which

danger must be visualized to be real and in which past experience (such as structures surviving earlier earthquakes) weighs more heavily than calculations of risk and probability. Fourth, because of the way in which the conflict develops, symbolic issues often displace practical concern for safety in public discourse. For example, a populist theme of local self-determination threatened by oppressive big government emerged in each case. Charges of discriminatory treatment, singling out the affected community arbitrarily from a large number of equally vulnerable communities for sinister reasons, were raised in each instance. And in each case well established life routines and the sense of being in control over significant life events were threatened by the proposed measures. Typically the government agencies work quietly behind the scenes for years before going public. Not having participated in the background preparation, public response is often to view the proposed action as hastily conceived and imperfectly thought out. Self-righteousness on both sides then augments existing impediments to mutual communication.

Change and Stability in the Public Response (Part Nine)

Announcement of the Uplift in February 1976 confronted southern Californians with a warning that involved zero lead time and an open-ended time window. We attempted to examine several hypotheses concerning possible effects of an open-ended time window. First, as time elapsed there might be a declining sense of urgency and reduced vigilance and preparedness. Second, a stronger "false alarm effect" involving active disillusionment and disbelief might develop. Third, there might be accumulating anxiety and fear as the period of waiting stretched out, leading to resistance to new information and defensive denial of danger.

Fourth, accumulating anxiety might be translated into anger, resentment, and scapegoating. But positive effects are also conceivable. Fifth, repeated discussion and media airing may make a new idea comprehensible through familiarization and its implications clearer through sensitization. And sixth, the waiting period may create opportunities for active and symbolic rehearsal of earthquake response, facilitating decisive action when the crisis comes.

The study of change and stability was made possible by the use of a panel design. A completely new sample of subjects was interviewed after each of four intervals of five to six months. In addition, still another new sample of residents were interviewed soon after the magnitude 5.0 earthquake on New Year's Day, 1979. The general pattern of change and stability was ascertained by comparing responses to the same items in these five surveys and the basic field survey. In addition, three of the four panels included a sample of respondents who were being interviewed for the second or third time, so that we could determine who changed and who did not.

Response to developing events. A number of significant events that might have altered people's reactions occurred during the period of waiting, so we included questions about them in the follow-up interviews. From March 1976 to December 1977 there were reports that the Uplift was rising in some places and subsiding in other places. About 16 percent of the sample interviewed in January 1978 remembered hearing of the sinking, and they were more likely to interpret this change as a sign that the big quake was nearer than to view it as lessening the danger. Thirty nine percent remembered reports of a swarm of small tremors in the Uplifted area, but they were more evenly divided about the probable implications. In July 1978 when we asked about a little publicized

April announcement by a Soviet scientist predicting a magnitude 7.5 earthquake before year's end, about a quarter of the sample remembered such an announcement, but very few took it seriously.

The successful Proposition Thirteen initiative campaign to limit property taxes stimulated much discussion of government spending. In November and December 1978, five to six months after the election, most people told us that Proposition Thirteen discussions had not changed their minds about spending to reduce earthquake hazards, with one third insisting we were still spending too little. Comparison of rates of endorsement for government spending before and after the campaign confirms that the campaign did not undermine popular support for government spending for earthquake hazard reduction.

By November and December of 1978, most people had heard of the moderate but destructive earthquake in August in nearby Santa Barbara, and a substantial minority thought it might be a sign that the Los Angeles earthquake was near. The quake stimulated about one person in four to wonder what public officials in Los Angeles were doing to prepare for an earthquake, but less than one in twelve claimed to have taken new steps in personal earthquake preparedness.

By the end of 1978 there was a widespread sense that media coverage and especially informal discussion of the possibility of a damaging earthquake had declined in the preceding year or two. Comparison of answers to similar questions asked at different times suggests a substantial drop in all media and types of discussion partners by mid-1978, with partial recovery after the Santa Barbara quake. There was less discussion of predictions, why earthquakes occur, family preparedness, and moving out. Discussion of quakes around the world and old, unsafe buildings remained steady, and discussion of flooding increased

dramatically--probably because of changes in the weather. The expressed desire for more media coverage of earthquake topics continued unabated, and the desire for more coverage of predictions by nonscientists increased significantly.

By the end of 1978 only substantial minorities of the people remember that there have been earthquake "false alarms," their memories are mostly vague and fragmentary, and in many instances they associate the false alarm with an announcement from a nonscientific source. Two people out of five say they take the Uplift as seriously as they ever did as the sign of a coming earthquake, and the rest divide fairly evenly between saying they take it more and less seriously. There does not seem to be any prevalent sense of disillusionment after nearly three years of waiting.

An incidental but important finding confirmed several times in these data is that when people have heard conflicting interpretations of the same event, they are more likely to maintain an open-minded attitude toward both versions than to be skeptical of both.

The record of change and stability. The number of earthquake announcements people remembered and the number of people who remembered one or more announcements declined sharply in the first period (February to August 1977), declined less sharply in the second period, and remained level throughout 1978, thus describing an exponential curve. Forgetting Minturn's forecast contributed heavily to this pattern, but other announcements exhibited similar trends. Dr. Whitcomb's "prediction" was no longer mentioned by the end of the period. But salience and awareness of Uplift held steady during most of the period. While the trend is for people to remember and take seriously fewer announcements, the trend is also to take seriously a larger proportion of the announcements they remember.

The most remarkable change is in the chief source people name for information about predictive announcements. Over the 22 months the significance of the newspaper doubles while television declines by more than a third, to the point that people finally mention newspapers more often than television. A plausible interpretation is that as the idea of earthquake prediction becomes more familiar to people, they turn to information sources that provide less superficial and more thought-provoking discussion.

The level of earthquake fear and concern and the proportion of people expecting an earthquake within a year drop significantly during the first period and then level off. Low as it was initially, salience appears to follow a similar pattern. However, when we examine the three fear-and-concern questions separately, the number of people who say they would try to be as far away as possible if they knew an earthquake were coming increases during the first period before leveling off. This combination of findings suggests that the sense of imminent danger stimulated by the events of 1976 declined after a few months, but at the same time the disposition to accept a destructive earthquake as a normal event was also being revised to a more realistic attitude.

Contrary to the disillusionment hypothesis, belief in eventual scientific prediction of earthquakes remains steady at the initial high level, while belief in present scientific prediction capability increases steadily and significantly. Equally contrary to the scapegoating hypothesis is the finding of no change in the number of respondents who suspect that scientists or public officials are withholding information or that they are doing so from self-interested motives. However, doubts about the desirability of releasing uncertain predictions increases over the 22 months. Belief in animal behavior and personal

premonitions as foretelling earthquakes increased during the first period when earthquake fear and expectation declined and then leveled off.

Fatalism about earthquakes probably did not change. The index of household preparedness based on 16 commonly recommended measures rose dramatically during the first period and dropped back during the second period without patterned change in 1978. When only measures taken and attributed to earthquake concern are counted, the same sharp rise and decline occurs in 1977 but an even sharper rise occurs in early 1978 and holds steady to the end of the year. The mid-1977 peak may have been the consequence of the peak period of group meetings concerned with earthquake preparedness during the first half of the year, followed by a slackening of activity when there were no more meetings. The 1978 peak reflects some kind of increased preoccupation with earthquake safety is not converted into action.

The proportion of people who were aware of some group in disproportionate danger from an earthquake increased, but the range of groups mentioned by the average respondent declined. Reference to people living in dangerous structures decreased while reference to people living in vulnerable locations increased. The poor were named considerably more often than earlier suggesting that earthquake issues are increasingly assimilated to more general political issues with the passage of time. Claimed membership in high-risk groups followed a similar pattern. There was an increase in optimism that something constructive could be done for the specially endangered, and a slight shift away from holding the endangered responsible for correcting their condition toward assigning joint responsibility to public authorities and the endangered. In balance, these findings suggest a somewhat more favorable climate for altruism and the acceptance of the need for collective action to deal with the earthquake threat.

New Year's Day earthquake of 1979. Interviews were administered a few days after the magnitude 5 earthquake on January 1, 1979. Although the quake was taken very much in stride and was not experienced with as much fear as people ascribe to past earthquake experiences or express over the prospect of a future damaging earthquake, it aroused considerable interest in the quake itself and its possible significance in relation to the anticipation of a more destructive quake in the near future. And it had an unsettling effect on several fairly well established attitudes about earthquake matters. The quake apparently undermined certainty about the significance of the southern California Uplift as an earthquake precursor, the eventual accuracy with which scientists will be able to predict earthquakes, and the value of the most popular earthquake hazard mitigation measures by government agencies. Fear of a future destructive earthquake was intensified as was the disposition to see a damaging earthquake as a crisis event, even though confidence that the predicted destructive earthquake would come within a year declined. Altogether the evidence fairly comprehensively refutes the lull hypothesis--that an earthquake of near-miss intensity lulls people into a false sense of security. At most the effect on personal and household preparedness was limited to some stock-taking with trivial numbers of people reassessing family plans for coping with an earthquake. An unsettling effect rather than either a lulling or heightened-vigilance effect seems to describe the consequences of the New Year's Day earthquake most comprehensively. The unpredicted near-miss wakened many people to the realization that a severe earthquake could not be treated as a normal occurrence and that accepted views about earthquake prediction and mitigation were uncertain. Since the quake was not a fearsome experience for most people, the increased

fear of future quakes was probably an indirect effect, brought on by the reflection and uncertainty provoked by the earthquake.

Although we cannot rule out alternative interpretations, the data suggest the possibility that even the weak crisis atmosphere provoked by this earthquake may have produced some closing of ranks, some subjective movement in the direction of community solidarity. The significant reduction in suspicion that scientists and officials were withholding predictive information before the earthquake is a surprising finding susceptible to this interpretation. Since the quake was overwhelmingly recognized as not having been predicted, while there was no reduction in the extent of belief in current earthquake prediction capability, there is justification for treating incipient solidarity as one plausible but unconfirmed interpretation of the data.

In the course of the analysis, at least four other findings emerged, mostly lending confirmation to findings already derived from other evidence in the course of this investigation. First, the tendency to personalize understanding remarked earlier was noted again. Although the total numbers were small, more people claimed to have had a personal idea that the earthquake was coming before it happened than claimed that the quake had been predicted. Second, there was widespread public concern over the meaning of the quake in relation to the prospect of future earthquakes in southern California. In the absence of authoritative attention to this question through the media, people turned to rumor as the prime source for ideas to be used to interpret the earthquake. Third, exposure to contradictory interpretations of the earthquake's meaning did not foster skepticism toward all interpretations, and may actually have augmented the disposition to treat alternative interpretations with an open mind.

Finally, a new observation of great importance emerged unexpectedly in the course of analysis. When people explained why they did not consider that this was an earthquake that had been predicted, it became clear that many if not most people were implicitly treating the near predictions, forecasts, and cautions they remembered as preliminary announcements. They assumed that these announcements were intended to alert them to be listening for short-term warnings that would be forthcoming when the time for action was at hand. This assumption would explain much inaction. And since scientists and government officials do not generally make any such assumption, this finding exposes an important realm of miscommunication and misunderstanding between authorities and the public.

The false alarm effect of near predictions. Widespread concern over the possibly deleterious effects of issuing earthquake predictions and warnings that later turn out to have been false alarms led us to reexamine our panel data from the point of view that announcement of the Uplift and subsequent warning statements might have constituted a slowly developing false alarm. Although a plausible case can be made that the people of southern California have been subjected to a slowly developing false alarm, the evidence makes it appear doubtful that most people experienced events in this way. Tests of seven hypotheses concerning differential susceptibility to false-alarm effects, each with four different dependent variables, were consistently negative. Individual and aggregate changes in earthquake response must be explained by other mechanisms than a false-alarm effect.

A second approach to explaining individual and aggregate change is more promising, though we cannot claim to have confirmed the hypotheses put forward.

Two principles have been deduced to explain the second set of findings. First, extent of media attention and extent of informal discussion serve as surrogates for actual events in assessing the credibility of an uncertain threat to the community. The more the threat is talked about, the more credible it seems, so that lessened media attention and its corollary in less frequent informal discussion reduced the credibility of the threat to the community. Second, when prevalent tendencies toward magical thinking and other causes are at work to foster unrealistic thinking, a steady level of media attention and informal discussion helps to moderate this unrealism. Consequently, reduced media attention and correlative declines in informal discussion contribute to less realistic conceptions of the threat facing the community and the problems of dealing with it. There is much more support in our data for this line of interpretation than for the false alarm interpretation.

Patterns of change. In balance, stability and moderate change of attitudes prevailed over striking changes during the period of our investigation, though we can only speculate about attitudes during the first year after announcement of the Uplift. The most plausible guess is that the first year was marked by gradually developing awareness and response which only settled into a more stable pattern after the first year passed. The relative stability is more plausibly explained by two circumstances. First, more people took moderate or tentative stances on most questions, so failure of the anticipated earthquake to occur was less unsettling than it would have been had more absolute views prevailed. Second, because of the normal anticipation of earthquakes in California, the various warning announcements added a sense of imminence but did not drastically change the accustomed sense of earthquake risk.

In several instances we can explain changed attitudes as delayed responses to changing coverage and emphasis in the media. Response typically lags several weeks behind shifting media coverage.

There is considerable support for the hypothesis that an extended period of waiting causes a reduced sense of urgency. However, there is no evidence of accumulating anxiety, and the evidence clearly contradicts the hypotheses of disillusionment and skepticsm and resentment and scapegoating as consequences of waiting. The hypothesis that waiting is a period of familiarization and growing appreciation finds suggestive support. But there is little confirmation of the hypothesis that waiting means rehearsal, except in some evidence that the normalcy bias was being displaced by more realistic attitudes toward the earthquake threat.

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CHAPTER TWO

RECOMMENDATIONS

Findings and conclusions are derived fairly directly from the analysis of data, and their validity can be affirmed or contested by reexamining and reanalyzing data. Recommendations, on the other hand, are stimulated by research and must take research findings into account, but they require the addition of judgment, experience, and values. Consequently it is unlikely that any two readers would agree completely on the recommendations that should be advanced on the basis of this research. Readers who are already actively involved in some aspect of earthquake hazard mitigation activity will certainly have formulated their own sets of recommendations while reading our conclusions. Because of our own limited experience with the application of knowledge to practical problems, our recommendations should be treated most often as suggestive rather than definitive. There is perhaps only one recommendation that we can state categorically, that:

1) All programs should be subject to continuing reappraisal on the basis of experience with their use, and on the basis of constantly reexamining research findings in the light of accumulating evidence and experience.

We shall offer our recommendations in three levels of generality. The most general kind of recommendation is one that identifies the problems most in need of attention, and the nonproblems that tend to divert attention and resources away from the more significant concerns. The second kind of recommendation is the statement of a general policy that should guide efforts to reduce the earthquake hazard. The policies we propose identify the principles that should guide efforts to deal with the problems already identified. Finally there are

more specific recommendations that constitute the concrete application of the guiding policies in specific situations, or directed to particular agencies. We shall deal with nonproblems and problems first, followed by the identification of broad policy principles. Reference to more specific recommendations will be integrated into these treatments of broader issues.

Nonproblems

Research reports on the social impact of disaster are replete with instances in which public officials have failed to act promptly and decisively before the onset of disaster because of conscientious concern about the possible harmful side effects of disaster mitigating measures. There is also evidence of scarce resources being expended on ineffectual measures to the detriment of potentially more useful programs. In both cases the concern over one set of problems impairs action to deal with another problem. Accordingly we believe it should be helpful to commence our recommendations by noting those instances in which problems that have attracted widespread attention are actually of less significance than is commonly supposed. We enumerate several minor problems and nonproblems that we believe can be deemphasized so that policy makers can turn their attention more resolutely to the real problems confronting them.

First, a great deal of attention has been devoted to making southern Californians aware that a destructive earthquake is in the offing, and to advertizing the scale of destruction that is anticipated. Perhaps frequent headlines of this character made a useful contribution to community awareness at an earlier period of time. But our evidence indicates that all but the unpersuadable few have heard and accepted these messages. From 66 to 71 percent

of the people in Los Angeles County expect a damaging earthquake within five years and only one percent are definite that such an earthquake will not occur in five years. A third or more of the people have come to expect the disaster within a year. Social psychological research dealing with other problems has repeatedly shown that the point of diminishing returns comes early in the use of scare tactics. Once people are generally aware of a problem, concrete and credible suggestions for action are more effective than repeated reminders of danger in getting people to do something about the problem. Our evidence shows that while level of household preparedness increases with increased levels of fear and concern, the relationship is reversed at the highest levels of fear. A crucial difference between people who merely remember various predictive announcements and people who took them seriously was in the belief that something could be done to reduce the hazard. Consequently we offer the following recommendation:

2) In efforts to keep the public alert to the earthquake hazard, officials should emphasize concretely what people can do personally and through public and private agencies to mitigate the earthquake hazard, treating reminders of the earthquake threat briefly as background information.

Second, concern was frequently expressed during the period of investigation that people were becoming sated with news and information about earthquake matters, and that continuing attention to the topic would produce a public backlash. We often heard speculations that the public resented being periodically reminded of the danger from impending earthquakes. After the extensive media coverage given Henry Minturn's forecasts during November and December of 1976 and their subsequent disconfirmation by events, this view was especially

often expressed. It is not unlikely that people were often frustrated by the repetitive nature of some of the news. And we did find considerable doubt about the wisdom of issuing statements to which scientists could not assign high levels of probability in the form of earthquake predictions. But questioned at three different intervals of time, an overwhelming majority of the people said there had been too little media coverage of earthquake prediction and earthquake safety, and hardly anyone said there had been too much. From the evidence it seems clear that the fears of a backlash were unjustified. Because of a media policy influenced by this misconception of popular demand, the public may have been kept ill informed of developments in which most people were interested, for a considerable span of time. Hence we recommend:

3) Scientists, officials, and media programmers should not be deterred from publishing and giving suitable prominence to newsworthy developments in the realm of earthquake prospects and earthquake safety because of any fear that the public will resent being reminded of the danger they face. When there is information of value, it should be published promptly and appropriately featured.

Closely related to this concern is the fear of a false-alarm effect from earthquake predictions and warnings that may not be confirmed by subsequent events. There is a prevalent fear that people will not believe the next prediction or warning after experiencing one false alarm, and that they will engage in scapegoating of scientists and public officials. We do not yet know what might happen if community life were totally disrupted on the basis of a public warning without a subsequent quake, nor what the effect of a succession of false alarms might be. But all the evidence we have concerning the effects of the announcement of the Uplift, Dr. Whitcomb's "prediction" that was withdrawn

eight months later, and Henry Minturn's disconfirmed forecast indicates that the fears are unjustified. Just as most respondents in a Japanese study felt that issuing a warning had been a good thing even though it turned out to be a false alarm, people in our study who took seriously one of the three 1976 announcements were more favorable than other people toward the public release of earthquake predictions in 1977. Other efforts to ferret out hypothesized false-alarm effects were equally unsuccessful. We are lead, therefore, to recommend that:

4) In general, public officials and scientists should discount prevalent fears that the issuance of a prediction or warning that is not subsequently confirmed by events will produce widespread skepticism of subsequent announcements, suspicion of official motives, and other false alarm effects. Only under exceptional circumstances would they be justified in withholding warnings and predictive announcements because of possible consequences.

In the same vein is the fear of publicizing scientific uncertainty and disagreement. Much scientific controversy is beyond public comprehension. But the fact of honest disagreement and uncertainty among scientists at the present stage of scientific knowledge, or during the early phases of a developing earthquake prediction situation, does not appear to be unduly disquieting to most people. We found that when people were aware of conflicting interpretations of particular earthquake events, they were no more skeptical of these interpretations than when they had heard only one interpretation. Our recommendation is

5) On matters of public interest and concern, scientists and media officials should not be deterred from presenting authoritative discussions by any fear that hearing authorities express disagreement and lack of certainty will cause public disillusionment and skepticism.

Most of our respondents were quite frank in admitting that they were frightened by earthquakes. A very small segment of the population undoubtedly lives in dread of the next quake. The danger of exacerbating these fears to the detriment of popular well being is often cited as a reason for suppressing or delaying warning announcements and for not launching public awareness programs and hazard mitigating activities that require public collaboration. Even greater concern is often expressed over the accumulating anxiety that may develop during an extended period of waiting for an indefinitely predicted disaster. The relative absence of attention to earthquake preparedness in school classrooms is frequently justified on the basis of a special susceptibility to such fear and anxiety on the part of children.

Our own investigation includes no information on children's reactions, though we see little reason to view the problem differently from the way we view the much more frequently reinforced fear of fire and violent crime that schools and parents are learning to handle constructively. We also call attention to research evidence showing that children are less likely to be disturbed by frightening television presentations when they have the opportunity to talk about them with peers and parents than when they do not. In response to indirect questioning our subjects showed very little preoccupation with the earthquake threat, and by frankly admitting fear when directly questioned, demonstrated that low preoccupation could not be attributed to defensive denial. Nor did we find evidence of widespread scapegoating. Even more significantly, the pattern of changing attitudes over a 22-month period provides no evidence of increased fear, denial, or scapegoating, such as might indicate an accumulation of pathological anxiety. Over the same period of time, there is some evidence of an increasingly realistic view of the earthquake threat. The most tangible

evidence of intensified fear is found in occasional rumor flurries, but these appear to have occurred in the context of a dearth of public information and discussion. Consequently it is our judgment that the general public is able to cope with the prospect of a destructive earthquake and the period of waiting with less personal disorganization and pathology than is commonly supposed. We recommend that:

6) Responsible officials should recognize that most people can accept and cope with the threat of a destructive earthquake without personal disorganization and pathology, especially when they are kept informed of the developing earthquake scenario and of hazard mitigation measures being undertaken, and advised on concrete preparedness steps that they can take personally.

Earthquake predictions are distinctive among disaster warnings in the fact that there is no demonstrated way in which the individual can confirm the imminence of danger through the testimony of his own senses. Consequently the reliance on science and scientists is even more critical in case of earthquake warnings than for most other disaster agents. Episodes of expressed hostility toward science have occurred frequently in recent years, in attacks on the teaching of evolution in schools, in public water flouridation controversies, and in the frequent identification of science with technology. In addition, astrology, various forms of mysticism, and prophetic religion have attracted great public followings in recent years. In light of the prevalence of unscientific belief and occasional open hostility toward science, there is understandable concern over whether scientific predictions will be accepted as credible bases for public action and whether public announcement of a prediction might provoke concerted attacks on the scientific community.

Our evidence confirms the widespread awareness of nonscientific earthquake forecasts, and especially the credibility assigned to personal observations (e.g., of animal behavior) and personal intuition and to the pronouncements of amateur scientists. These are significant realities that are not likely to change in the near future and must be accepted as facts of life. But two findings from our study cast a distinctive light on these realities. First, science and scientists are consistently assigned highest credibility and respect. Second, most of the people who believe in nonscientific grounds for earthquake forecasting also believe in scientific prediction capability. For most people, then, science is the ultimate but not the sole arbiter. Strongly antiscientific attitudes are held by only a very small faction of the public. We stress that it is neither necessary nor wise for scientists to attack the adherents of nonscientific beliefs in the course of establishing the credibility of their own pronouncements.

7) It should be recognized that scientific and nonscientific beliefs coexist in popular thought, and that for most people the acceptance of nonscientific beliefs does not undermine the superior credibility that they assign to science and scientists. Thus scientists should discuss the scientific evidence relative to their own announcements and the forecasts from nonscientists without simultaneously launching attacks on nonscientific belief systems or their adherents.

In light of the spectacular and familiar character of emergency response activities such as rescue work and fire fighting, it is plausible to suppose that the public would be oriented more toward emergency response than toward disaster mitigation activities. A lack of public appreciation for the need to work at

reducing hazards before an earthquake strikes as well as to prepare for effective emergency response could hamper the former programs. Our evidence, however, indicates that this fear is unjustified. When people were asked to suggest steps that government agencies should be taking in preparation for an earthquake, as many or more of the suggestions offered dealt with hazard mitigation as with emergency response. Accordingly:

8) Officials should recognize that there is widespread public appreciation of the need for hazard mitigation as well as emergency response programs.

Government and government officials are popular targets of criticism and blame for the evils in society. Cynicism about the motives of elected officials and "bureaucrats" is a conventional element in public discourse. It is a serious question whether the credibility of government is so low as to undermine the exercise of constructive leadership in earthquake planning and in an earthquake crisis. We do find that only one person in five will say that public officials are doing a good job in earthquake preparedness. However, when we asked one year later how well prepared government officials were for dealing with a future damaging earthquake, more than half the people said they were at least "somewhat" prepared. More important, however, people evaluated government preparedness more favorably than their own preparedness, and much more favorably than general public preparedness. People expressed overwhelming support for government expenditure for earthquake hazard reduction and consistently looked toward government as the responsible agent in dealing with earthquake hazard. Even the release of earthquake predictions was viewed by most people as partly or wholly a government responsibility. So skepticism about government accomplishments must be seen in relative terms, and the strong expectation for government leadership recognized.

9) Government officials should recognize that the public looks overwhelmingly to them for leadership in preparing for earthquake disaster, and that prevailing attitudes toward government are marked more by ambivalence than by outright negativism. In some areas of disaster preparedness the public credits government agencies with more than they have actually accomplished and expects more leadership than they are disposed to offer.

A final problem that we believe has been overemphasized to the detriment of constructive disaster planning is the prospect of a disabling economic recession following the issuance of a long-term earthquake prediction. The expectation of an economic recession is based in part on commonsense economics and in part on the widely publicized early reports from the study by Eugene Haas and Dennis Mileti. These investigators interviewed a panel of business and financial leaders in California, presenting two scenarios of unfolding earthquake predictions and asking the interviewers to state what plans their companies would make in response to the predictions. In order to simulate true decision making circumstances, the investigators used a delphi method in which the business leaders were informed of findings from the first round of investigation and also given answers to crucial questions they had raised and then allowed to revise their answers on the basis of this additional information. Since what business leaders decide to do would undoubtedly be strongly affected by what they thought other business leaders were doing, and by other critical reactions in the community, the procedure should have produced more realistic findings than the usual one-time survey. But Haas and Mileti were forced to supply their own estimates in answer to some of the crucial questions. In particular, business leaders

wanted to know whether substantial numbers of people would be leaving the area before the date announced for the quake. Haas and Mileti estimated that there would indeed be substantial outmigration, and business leaders took into account the anticipated effects of this outmigration on their businesses in reporting how they would respond to the earthquake prediction.

It is clear that the response of business and financial leaders in an actual prediction situation will be affected directly by the definiteness of the predictive announcement with respect to place, time, and magnitude, and the probability level assigned to the prediction, as will the response of the public in deciding whether to move away from the threatened area. Our own superficial examination of unemployment records and property values failed to reveal any effects attributable to the 1976 warnings in Los Angeles County. And since no more than ten out of 1450 people interviewed in early 1977 gave earthquake danger as even a possible reason for moving away, it seems clear that there had been no significant outmigration. From studies of other types of disaster warning it is clear that such radical responses as moving away are unlikely for any significant fraction of the population unless warnings are quite definite, imminent, and affirmed with a high degree of certainty.

At the time the Hass-Mileti investigation was launched, many earthquake scientists saw the dilatancy-diffusion theory as a breakthrough that would permit the issuance of rather precise and confident long-term predictions. Later experience has demonstrated that the thoery is not the panacea once hoped. Even the possibility of specifying location has been called into question recently. Seismologists must rather deal with a catalogue of potential anomalies, not all of which appear prior to every earthquake, and no one of which is a

certain indicator of an earthquake to come. Accordingly, high degrees of certainty are unlikely until quite close to the earthquake's time of occurrence, when potential economic recession is no longer a problem. Because great earthquakes are infrequent occurrences in the United States, earthquake gap theory, which produced the notably successful prediction for Mexico in 1978, can only justify the assertion of a fifty percent probability of a great earthquake in southern California within twenty years. For prediction based on precursory anomolies, the Uplift may be the prototype for long-term prediction. Substantially more certain predictions with shorter time windows based on gap theory are only conceivable for southern California in the unlikely event of an earthquake that is already delayed much beyond the typical recurrence interval.

If, as we suppose, long-term predictions that are precise as to time, place, and magnitude, and issued with 80 to 90 percent probability estimates are unlikely for southern California within the forseeable future, we have no reason to fear either mass outmigration or economic recessions connected with earthquake predictions. Even with the Haas-Mileti scenarios and the artificial credibility produced by the research enterprise, half of the business and financial leaders still reported that they would take no adjustive actions. With less definite prediction scenarios and without massive outmigration, it is doubtful that most major business concerns would deliberately yield competitive advantages in the lucrative southern California market to less cautious firms by reducing the scale of their own business activities. We believe that it is now safe to conclude that the fear of a crippling economic recession in case of a long-term earthquake prediction has been a red herring that has served only to foster unwarranted ambivalence toward frank public discussion of the earthquake threat and to divert much needed attention away from

the more credible prospect of community disorganization in connection with warning of an imminent earthquake. We shall address the problems of short-term prediction later. We recommend that:

10) Public officials and scientists should view the prospect of a crippling economic recession in the aftermath of a long-term earthquake prediction as a highly improbably occurrence within the United States because of the unlikelihood in the foreseeable future of long-term predictions of sufficient specificity and certainty of occurrence to provoke significant outmigration and substantial revisions in business and financial planning.

If this extended list of nonproblems has created the impression that there are no problems connected with earthquake predictions, near predictions, and warnings, that is a faulty impression. The problems are real and substantial. We hope that by clearing the decks of nonproblems, we can help responsible officials to focus their attention and planning on the real problems.

Problems

The problems highlighted by our findings fall into the areas of media transmission of information, public awareness, message credibility and comprehensability, support for public action, and individual and household preparedness.

The media. Except for the supermarket check-out stand papers and some of the radio and television talk shows that feature sensational and ill-founded forecasts of disaster, the media generally followed a responsible course during our study period. Newspapers, television, and radio kept to a middle course, employing neither scare tactics nor denial. The one notable exception was the attention and authentication given to Henry Minturn's forecast by local and nationwide television, though even in this case the sampled

newspapers either ignored or were critical of Minturn's claims and credentials. It is doubtful that Minturn's forecast would have created more than a ripple, or that hundreds of thousands of southern Californians would have mistaken him for a qualified scientist, if he had not been featured and interviewed on television. Hence our first recommendation:

11) Before featuring any earthquake forecast or forecaster, media personnel should investigate the credentials of the forecaster, giving the forecast prominence and attention only in proportion to the credibility of the source, and including the findings on the forecaster's credentials prominently in all items dealing with the forecast.

This recommendation does not mean ignoring or supressing news, but insuring responsible reportorial and editorial work. Adhering to the recommended policy will not entirely prevent flurries of rumor and agitation such as accompanied the more recent (1981) earthquake forecast by a prominent stock broker, but will moderate their impact and lessen confusion with scientifically based announcements.

The most frequent problem we encountered in media coverage was the lack of continuity between successive news and feature items and the failure to provide completion and retrospective interpretation for passing events. Often, different reporters were assigned to the earthquake topic at different times, each taking up the topic without a command of relevant past events or other essential background information. As a result, material presented to the public over the three-year period was often repetitive rather than cumulative, sometimes contradictory and confusing, and often left important stories unfinished. It may well have been the repetitive and elementary treatment of earthquake

topics by television that caused a shift from television to newspapers as the chief source of information about earthquake prospects between early 1977 and late 1978. Even in the Los Angeles Times, the quality and continuity of - whose treatment surpassed that in all the other media, a humorous story on April 9, 1981, about the discomfirmed stockbroker's forecast coupled disparaging references to earlier Doomsday forecasts by evangelists with the comment: "Then there was the more recent alarm over the Palmdale Bulge, a lump in the desert supposedly indicative of strain along the San Andreas Fault." Treating these events as if they were all of a kind could have undermined the serious treatment of the Uplift by the paper's science editor throughout the preceding four years for some readers. Very few of the media even reported Dr. Whitcomb's withdrawal of his near prediction, and those that did failed to explain adequately the grounds and significance of the cancellation, or to give the story attention commensurate with the interest the near prediction had attracted earlier. We recommend:

12) Media should give attention to insuring continuity in their coverage of the earthquake threat, appropriate completion and retrospective interpretation of continuing stories, and cumulative reporting that allows later stories to build on earlier ones rather than merely repeating elementary coverage.

Related to the problem of continuity is the tendency for the media to deal with earthquake preparedness and understanding with one-time specials that attempt to cover the subject comprehensively, followed by long periods of silence. Excellent as the Fil Drukey supplement on household preparedness was, we wonder how many people read it completely, gave attention to all the suggestions, or went back to it a second or third time. We suspect that a weekly or biweekly feature on earthquake preparedness, taking up one or two measures at a time,

and briefly reviewing earlier suggestions from time to time, could have had more effect on actual behavior. For example, one feature might be devoted to encouraging people to assemble a week's supply of nonperishable food that could be eaten without cooking. Six months later the feature might deal with review and replenishment of the emergency food cache. We recommend:

13) The media should deal with earthquake preparedness and understanding through regular and continuing series in which information and advice are presented in manageable units, with appropriately scheduled followup, rather than relying principally on infrequent but comprehensive special features.

There is understandable debate over the proper attitude of the media toward unfounded rumor. By acknowledging and publicly refuting rumors, do the media inadvertantly expand the circulation of the rumors and lend indirect credibility to them? Or could the media effectively stifle rumors by promptly investigating and reporting on them? In case of the moderate earthquake of New Year's Day, 1979, people seem to have turned to rumor to fill the vacuum left by failure of the media to address the question they were most concerned about, namely, the relationship of this quake to the anticipated great earthquake. In fall of 1977 rumors flourished while the media kept their discrete silence, and interest in Minturn's forecast mushroomed while the skeptical sector of the media studiously ignored Minturn. It seems clear that media silence does not dampen the spread of rumor, and that rumor often flourishes to fill an information gap in the media. Our recommendation is that:

14) Media should insure prompt and sufficient authoritative discussion of earthquake issues with which there is significant public preoccupation, and should promptly investigate and present authoritative discussions concerning rumors about impending earthquakes and other anxiety-producing earthquake topics.

To some extent the preceding problem is related to another characteristic of the media. For the most part the media simply report what is brought to their attention, as elaborated or amended on the basis of their own cursory investigation, rather than actively seeking and creating newsworthy material. As a result, news about the earthquake prospect, preparedness, and safety issues appears when agencies such as the U.S. Geological Survey issue statements, when public meetings are held, and when political controversy heats up. The news content is largely based on material supplied by the agency or presented in the meeting. Occasional instances of investigative journalism like George Alexander's (L.A. Times) expose of Henry Minturn are welcome exceptions. It might be unrealistic to expect the media to invest major investigative resources into earthquake safety on a regular basis, but there are instances when the media could have exercised greater initiative to the benefit of the community. Because the media representatives are more directly and continuously in contact with a wider range of people than agents from scientific and even governmental bodies, the media are in a favored position to identify public needs and concerns. It was about ten months after initial announcement of the Uplift before the media gave comprehensive attention to problems of individual and household earthquake preparedness. The need should have been obvious at once. But no agency had the development of advice on this topic as a major responsibility. Other than some scattered items of off-the-cuff advice, which came a few months after the Uplift announcement, the media did little until an interested citizen voluntarily assumed this responsibility and prepared the valuable earthquake survival manual which several newspapers then distributed and the public accepted with alacrity. Sensing the need, the media might have taken initiative on this matter earlier. Similarly, reporters aware of public concern over the implications

of the New Year's Day quake could have taken the initiative in arranging public discussion by respected scientists. Our recommendation is as follows:

15) The media should exercise greater initiative in times of recognizable need that is not being met by other agencies to assemble relevant information through investigative reporting and arrange discussions on a timely basis.

Because of the critical part played by the media in transmitting and interpreting the news, many of the recommendations presented under other headings apply equally to the media. The five that we have reviewed under this heading are only those that concern the broadest questions of media policy.

Public awareness. Although there is almost universal awareness of the prospect of a great earthquake and only a trivial number of people claim personal invulnerability, only a minority have anything approaching specific knowledge. Nearly half the people either had not heard of the southern California Uplift or did not recognize its possible connection with a coming earthquake. Many people confused the amateur forecaster, Minturn, with the Cal Tech scientist, Whitcomb. Almost noone remembered that Whitcomb's "prediction" had been withdrawn when questioned two years later. It would be unrealistic to expect the lay person to command a fund of very detailed knowledge, but widespread appreciation of an essential core of information would help people interpret new events and minimize the problem of rumor. We recommend that:

16) Attention should be given to identifying and promoting a minimum feasible complement of information about the earthquake threat that is needed to place developing events in perspective. An agency such as the California Seismic Safety Commission, in collaboration with scientists, local government officials, and journalists could appropriately take the lead in carrying out this recommendation.

Public awareness varies greatly for different earthquake hazards. The dangers from old buildings and from living on or near a fault are almost universally appreciated, and awareness of tsunami danger is widespread. But there is a strange insensitivity to the danger from potential dams collapsing in an earthquake. Similarly, the possibility of uncontrolled brush fires and even fires within built-up sections, and the likelihood of severe damage to lifelines with its consequences for survival in the city, are seldom appreciated. But before we recommend simply that people be made more aware of these hazards, we must evaluate the uses to which that awareness can be put. In southern California, with its mild climate, much of the problem of lifelines for the average resident can be handled by storing a week's supply of water and food that can be eaten without cooking and kept without refrigeration. Accordingly, we recommend that:

17) The Seismic Safety Commission of the California Office of Emergency Services should foster, through the media and local government, greater awareness of earthquake hazards to lifelines, the probably consequences and duration of their disruption in a great earthquake, and the steps that can be taken by each household in preparation for such an eventuality.

For wildfires and flooding, the lack of public awareness corresponds to the primitive state of public planning for dealing with these hazards. The Office of Emergency Services has been assembling locally devised evacuation plans for inundation areas, but it is difficult to imagine how such an evacuation plan could be placed in operation effectively without advance public familiarization. We recommend that:

18) Plans for evacuation to safe areas should be devised for potential dam inundation zones and areas subject to threat in case of brush fires and disseminated to all residents in these zones, and that information concerning these

dangers be included in all regular discussions of earthquake hazard. We are fully aware that ths recommendation will stir up political controversy, and will be resisted by real estate interests and even by resident home owners who fear reductions in property values. But the concern for saving lives in a not improbable emergency should take precedence.

Awareness of all kinds is quite unevenly diffused throughout the population and special efforts will be needed to reach some segments. It is not surprising to find that the socioeconomically depressed, the less educated, Blacks, and Mexican Americans are less fully informed. Perhaps it is surprising to find that young adults, including the parents of young children, are less informed than older adults. We recommend that:

19) Special attention be given to the problem of getting earthquake information to young adults and the parents of young children and to Blacks, Mexican Americans, the socioeconomically depressed, and the less educated population segments.

Not all population segments are equally capable of preparing for an earthquake or coping with its consequences. A critical component of effective community response to any disaster is an altruistic response that takes notice of people in special need of assistance. While most people are aware that some groups of people are in greater danger than others, attention turns to the inhabitants of old buildings and people in dangerous locations more than to people whose personal condition and resources impair their ability to deal effectively with the earthquake threat. And there is even less awareness of what individuals and service organizations might do for them. We recommend that:

20) A serious study of the special needs of different population segments in earthquake preparedness and in coping with earthquake disaster should be undertaken by service groups and churches with a view to establishing continuing service projects.

Sustaining awareness of earthquake hazard during an extended period of waiting did not turn out to be as great a problem as might be supposed. A drop in awareness and concern after an event-rich period was characteristic, but awareness and concern soon stabilized. We assume that the stable level was maintained by periodic new reports in the media. But the stable level was unsettled by the occurrence of a moderate though benign earthquake. While most of the earlier detailed information is no longer part of public memory, there appears to be a resurgence of interest and concern at the time of this writing. The problem for attention, then, is less to maintain a level of awareness than to stabilize awareness and concern against non-productive oscillations. This can probably best be accomplished by maintaining a more steady flow of information with periodic progress and status reports on the earthquake threat, and prompt public discussion of the significance of unfolding events. We recommend that:

21) Scientists and the media should cooperate in establishing routine periodic status reports and prompt interpretative discussion of events that attract public interest.

Reminding people of the old information requires more ingenuity, since an audience may soon weary of hearing the "same old thing" repeated. Occasional use of a test or game format may stir interest, as did the very popular disaster survival test aired by NBC in mid-1977. We recommend that:

22) The media in collaboration with scientists and state agencies should use innovative devices such as preparedness tests and games to remind people of the essential information for earthquake preparedness.

A final, more general problem of awareness is the relative absence of "local experts" or opinion leaders to whom people can turn for help in the essential process of interpreting what comes to them from the mass media. Sociological research on public opinion formation has demonstrated the important role played by informal opinion leaders who are more informed and interested in particular issues than the general public. When readily accessible in the neighborhood or work-place, these people become known to their associates for their superior understanding in a special sphere of activity. The local expert is someone to turn to for clarification of confusing or disturbing reports and for assistance in making difficult decisions on a person-to-person basis. Our investigation shows that people who know someone they regard as a local expert are better informed and more alert to the earthquake hazard and earthquake safety than those who do not. But only a disturbingly small proportion of the people include such an expert among their friends and associates. When we confront the small number of people whose awareness goes beyond the vague conviction that a great earthquake is coming soon, the absence of local experts to sort figure from ground in the media reports may be a significant variable. The cultivation of a larger number of local experts, scattered throughout the community, could have a multiplicative effect on awareness and possibly on active earthquake preparedness.

Local experts are often pure amateurs who have developed a special interest and stay informed as part of a personal hobby. But they are more often people for whom the earthquake interest is a natural extension of some more far reaching recreational interest or of their occupational competence. The construction worker, the architect, and the building contractor can come naturally by an interest in earthquake safety. The local rock hound or outdoorsman comes naturally

to an amateur's interest in geology that can easily be extended to a general concern with earthquake safety. Teachers, police, and others involved with public safety can often become interested. In order to create the needed critical mass of local experts, it will be necessary to work through relevant professional and amateur associations and within different community segments to stimulate interest, provide training, and establish continuing communication to keep interest alive and knowledge up to date. Undoubtedly the corps of amateur animal observers organized by SRI and served with a regular informative news letter constitutes the most effective example of a program which, as an important side effect, has created a significant body of local experts. We recommend that:

23) The Seismic Safety Commission or California Office of Emergency Services should develop a program to increase several fold the number of local experts on earthquake threat and earthquake safety in all segments of the population. The program should work through relevant professional and amateur associations, and the network of local experts should be maintained through regular communications included in their organizational newsletters.

Message credibility and comprehensibility. In spite of the widespread respect for science, messages concerning earthquake threat and earthquake safety are often misunderstood, and some messages are even rejected. Our evidence shows that many--and perhaps even most--people translate technical messages into terms that they find comprehensible before accepting and acting on them. People want to understand messages rather than merely accepting them on authority, and they often place crucial faith in an intimately personal kind of understanding. The authority of science creates a predisposition toward accepting the scientific message, but does not insulate it from the test of comprehensibility and credibility. And when a message affects people's apparant interests detrimentally, incomprehensibility

often serves as the justification for rejecting the message. Often the problem of credibility relates more to the technical and legal use of science than to the scientific finding itself. People incensed by the impending designation of a newly identified active-fault location as a "special study zone" under California law could not understand why they should be concerned over a fault that was last known to have shown movement six thousand years ago. No satisfactory explanation for this definition of an "active fault" was supplied by the scientist present. There is also a prevalent suspicion that many scientists can be "bought" by special interests, and this may be especially the case with geologists and engineers. When this suspicion is in force, techincal language and obscure explanations are seen as devices to pull the wool over public eyes. Even when communications are intended primarily for the ears of technical experts in government agencies, their reception by a lay public can severely affect the ability of the government officials to act on the information.

A simple willingness to explain whatever is not immediately comprehensible in commonsense terms goes a long way. Scientists are often asked whether California will break off from the continent and fall into the Pacific Ocean, but seldom treat the question patiently and nonpatronizingly as a serious question by explaining why this is not what would happen in a great earthquake. The use of simple metaphors from familiar experience and examples from common experience is usually effective. We recommend that:

24) Scientists and interpreters of science should be prepared to make their analyses of earthquake danger comprehensible in commonsense terms by frequent and imaginative use of metaphors and examples from common experience.

Another problem is suggested by the finding that earthquake forecasts

attributed to scientific sources are associated with lower intensities than earthquake forecasts from nonscientific sources. Many people who recognized that the Uplift might be a precursor to a great earthquake nevertheless thought there would not be damage where they lived. This tendency not to appreciate the potential severity of the earthquakes that scientists were talking about may be a consequence both of the qualifications that scientists include in their expositions and of an alarm-and-reassurance pattern that we encountered repeatedly in media reports of scientifically based earthquake warnings and near predictions. The qualifications and the wariness against seeming more definite than the evidence would justify may account for the finding that fewer respondents could specify the intensity of earthquakes forecasted by scientists than could do so when the source was nonscientific. The alarm-and-reassurance pattern was one in which the anticipated earthquake and its effects were described dramatically, and then, as if to reassure the reader, the uncertainty of the prediction, its remoteness in time, the ability of most southern California buildings to withstand earthquakes, or the trivial protective measures called for were announced. For example, after Dr. Whitcomb's near prediction, many discussions concluded with the observation that Californians take earthquakes in their stride, merely removing their hi fi speakers from the wall and pushing their best bottles of Scotch to the rear of the shelf. Many readers may have been lulled into a false sense of security by this alarm-and-reassurance pattern, and discouraged from planning seriously for their safety in case the near prediction should have proved true. We recommend that:

25) Scientists, public officials, and media reporters should attempt to present accounts of earthquake predictions, near predictions, and general warnings in concrete and specific terms, carefully phrasing qualifications so that they do not convey a sense of vagueness, and couching whatever reassurances they

feel are necessary in terms that do no trivialize or otherwise undercut the message of earthquake threat.

An unexpected finding in the aftermath of the moderate earthquake on January first, 1979, called our attention to what might turn out to be a serious problem. Respondents were asked if they knew of any outstanding earthquake prediction or warning, and whether this quake could have been the one predicted. Most people thought it was not the predicted quake. When we asked why, the most frequent answer was that there was no last-minute warning issued. The actual number of people who gave this answer constituted a small minority of the total sample, but when extrapolated would still represent a substantial segment of the population of Los Angeles County. Our greater concern, however, is that this finding may be merely the tip of the iceberg, hinting that many people may have formed conceptions of the earthquake prediction and warning process that are not justified by present circumstances. Certainly there is no basis on which responsible authorities could have assured people that the longer term near predictions such as were associated with the Uplift would be supplemented by a short term warning when the earthquake was imminent. Yet it appears that thousands of people have somehow gained the reassuring conviction that such a warning will be issued. Besides lessening the urgency of earthquake preparations, this misconception would surely provoke angry resentment against authorities in case of a destructive quake without a short-term warning. We recommend that:

26) State agencies concerned with earthquake safety should prepare information periodically for media distribution that clarifies the actual scenarios expected under the present state of earthquake prediction capability, aiming particularly to dispel false expectations of precise and last-minute warnings.

Recurrent efforts should also be made to ascertain the prevalent popular expectations and assumptions concerning earthquake prediction and warning scenarios, and these findings should serve as the basis for frequent revision in the kind of information disseminated.

Support for public action. When the issue is raised without reference to priorities, public support for government action to reduce earthquake hazards poses no problem. The problem we encounter is of the opposite kind: there appears to be excessive reliance on government to deal with the earthquake threat. The majority of our respondents wanted government to underwrite some or all of the costs of upgrading unsafe structures. Most of our respondents looked to government to lead in resolving the problems of exceptionally threatened groups. Realistically, the contribution that can be made to these problems strictly through government action is quite limited. A good deal more government initiative and leadership than has yet been demonstrated is possible but substantial progress will require extensive involvement of private agencies and citizen groups. Such excessive reliance on government can be counterproductive in many ways that are too obvious to require enumeration. A constructive approach to the problem must be two-pronged. On the one hand government officials need to make clear what government can do and what government cannot do. A balanced declaration including the very substantial and positive steps that government agencies can and are taking and the responsibilities that must be assumed by nongovernmental agencies and citizen groups should contribute toward lessening this problem. We recommend that:

27) State and local government officials should collaborate in preparing a policy statement for wide public distribution, specifying briefly and in simple and concrete terms the contributions that can be made to earthquake hazard reduction and emergency preparedness by government agencies, the limitations

to government action, and the contributions that can and should be made by private agencies, citizen groups, and individual citizens and households.

An anomalous finding from our investigation--but not an unusual one--is that while people overwhelmingly applaud the expenditure of government money for the reduction of earthquake hazards, they assign a relatively low priority to expenditures for this purpose in comparison to expenditures for improved public education, police protection, and health care. The anomaly places public officials in an untenable position, subjecting them to criticism for not acting in response to public demand for earthquake safety programs, while subjecting them to equal or greater criticism when they do so by shifting the allocation of public funds away from more popular enterprises. We have no ready solution for this problem. It is a familiar one for government officials, but that makes it no easier to deal with. In many cases the obstacle to government action is not the high cost of the program to the taxpayer, but resistance on the basis of special interests. Many of the earthquake safety programs that we and others have recommended are not very expensive in tax dollars, so the anomalous public attitude should not deter government officials from enlarging their effort substantially. But some of the desirable programs are quite expensive, and their advancement will often be difficult. Support for such programs may be won when expenditures and accomplishments are viewed over a span of years as the basis for setting priorities, rather than on a year-by-year basis. With apologies for having no real answer to this problem, we recommend that:

28) Public officials should recognize the contradiction between strong public support for government action to reduce the hazards of earthquakes in combination and the higher priorities for government expenditure assigned to such public concerns as education, crime, and health care except in the immediate aftermath of a local earthquake disaster. Assessing relative commitments to competing

programs over a span of several years rather than on a year-by-year basis may help to advance the cause of earthquake programs.

While people look disproportionately to government for leadership, their overall evaluation of government accomplishments in dealing with earthquake preparedness problems was not very favorable at the time of our initial survey. Better informed people were more critical than less well informed people, so this finding deserves serious attention. The bright spot, that people rate government preparation higher than their own preparation, can offer only small comfort to government officials. Part of the problem was that people had very little idea what government agencies were doing, and better information about earthquake preparedness activities would help in this respect. But there is probably a more substantial basis for the prevailing public evaluation, that government agencies have not accomplished all that informed citizens expect of them. We recommend that:

29) Public officials should explore the causes for public doubts about their progress in dealing with earthquake preparedness, providing better public information about their positive accomplishments and identifying areas in which more government progress ought to be achieved.

Household and individual preparedness. While our data indicate an impressive level of awareness of survival techniques during earthquakes such as standing in an inside doorway and staying away from windows, the number of people who have taken concrete steps to prepare themselves and their households for an earthquake is quite small. Among households with children, only half report that they have instructed the children what they should do in case of an earthquake. Many fewer have made family plans for reunion after an earthquake or participated in neighborhood planning or stored up food and water. The level of preparedness rose

by mid-1977, but fell again by year's end. The increased preparedness may have resulted from the many public meetings concerned with this topic during the first half of 1977, though it seems unlikely that enough people participated in these meetings to account for the general increase. More likely the NBC Disaster Preparedness Test program had a temporary effect, in combination with the meetings.

In an earlier recommendation we proposed that preparedness information be disseminated in smaller doses on a more regular basis as part of a continuing rather than an all-at-once program. But we also want to stress that recommendations of this sort have not reached the public with the seal of respected authority. Enterprising individuals and citizen groups have performed yoeman service in preparing recommendations, but these simply do not have the force of proclamations from respected government officials or agencies. Recommendations carrying the stamp of the Seismic Safety Commission, the California Office of Emergency Services, or even the less well known U. S. Geological Survey could command more attention, especially if referred to the public through the media by local mayors or other well known public officials.

In addition, we suspect that the reasons for many of the recommendations are not clearly understood. We have mentioned already that metropolitan life-line vulnerability is not generally appreciated, with its implications for food and water storage. Each recommendation needs to be presented in association with an exposition of circumstances that make it important. In some cases, such as whether or not to turn off the gas after an earthquake, conflicting recommendations have reached the public. Even though the authoritative view now seems to be that householders should be prepared to turn off the gas in case of fire or escaping gas but should not do so in the absence of these conditions, this recommendation is

probably not generally understood because the rationale behind it has not been communicated effectively.

In addition to our earlier recommendations concerning the way in which earthquake information should be communicated, we recommend that:

30) Carefully prepared and selected advice concerning earthquake preparedness for individuals and households should be given widespread and repeated public distribution under the official auspices of an authoritative government agency such as the California Seismic Safety Commission, and with the public endorsement of well-known local government officials and public personages; and that

31) Each recommended measure for individual and household earthquake preparedness should be presented in conjunction with a brief but credible explanation of the circumstances that justify the recommendation.

There is some reason to believe that what to do at the time of an earthquake has been more effectively communicated than the steps that should be taken now in anticipation of a possible earthquake. This imbalance is especially ironic in light of the fact that shaking in a great earthquake may be so severe that many people may not be able to apply the rules they have so assiduously learned, while adequate preparedness could limit damage and personal injury during the quake and reduce suffering in the hours and days directly after the earthquake. There have been a few valuable media programs identifying points of danger about the home such as heavy objects that could fall from walls and shelves. An enterprising citizen's group in Berkeley, California, organized a self-help program of earthquake safety for householders, including inspection to determine whether the home was properly anchored to its foundations. Most people have not yet been adequately exposed to such information, and when they have they have often not received usable

information about how to correct the dangerous conditions or where to secure dependable help. We recommend that:

32) The California Seismic Safety Commission or other responsible state agency should develop a program to promote earthquake safety in the household, making use of local government, private agencies, and citizen groups to arrange for guided earthquake safety insepctions of their homes by residents in vulnerable communities, and for practical guidance and assistance in correcting unsafe conditions.

Policy Recommendations

The identification of problems requiring attention and the specification of strategies for dealing with these problems cannot be separated, and we have already broached many issues of policy in the course of discussing problems and nonproblems. And it is equally impossible to address policy without referring again to problems. But in the remaining discussion we shift our emphasis so as to focus less on the identification of problems and more on the assessment of strategies for dealing with problems.

Cultivating realistic public understandings. If we are to assess the appropriateness and effectiveness of public communication and the adequacy of public awareness and concern, we must have a reasonably clear conception of our goals. Is our primary aim to create an alert public? Or is it to minimize disruptive fear and anxiety? Do we seek a sophisticated and technically informed public who can second-guess the scientists and government policy makers, or a public who recognize and respect the most competent authorities in each realm? Are we primarily concerned to keep the community and the economy sailing on an even keel throughout the potentially stormy period of waiting for an earthquake, or do we

want to create a readiness to accept a radically altered course when necessary? Such alternative goals as these exemplify the dilemmas of communication. Implicit choices are constantly made according to the vantage points of particular agencies and individuals. The reluctance of elected public officials to acknowledge near predictions of damaging earthquakes until they can be translated into almost certain predictions reflects the implicit choice of maintaining society on an even keel. Ambivalence over the choice between alerting the public and allaying anxiety is the source of the prevalent alarm-and-reassurance pattern of public communication to which we have already referred.

It is time to recognize that choices of the sort we have illustrated can never be resolved in general policy terms. Attempts to orient policy according to some choice or reconciliation among such objectives lead into a miasma of self-defeating vacillation and misguided effort to weigh imponderables. In relatively extreme situations it can become clear that one or the other ends of a polarity requires emphasis, though even such decisions that seem obvious at the time often appear counterproductive in retrospect. Such is often the case when official preoccupation with providing reassurance for an agitated population takes over in a crisis situation.

The difficulty with defining policy in such terms as the foregoing polarities lies in the underlying assumption about how to deal with the public in difficult situations. The fundamental objective underlying each of these alternatives is to manipulate the public, on the assumption that the public cannot be trusted emotionally to cope with crisis or to exercize appropriate judgment in light of the facts of the situation. This distrust of public equanimity and judgment is widespread. Hardly a policy discussion by public officials takes place without some proposal to control or slant the flow of information on the assumption that people cannot be trusted with undoctored information. Hardly a discussion of earthquake prediction among scientists takes place without expressed concern over whether the public can cope with full awareness of the risks they face. Many of our respondents believed

that scientists and public officials were withholding information, not out of self-interest but because of concern for public welfare. Distrust of the public is indeed a grass-roots phenomenon and not an exclusive penchant of authorities. Our data reveal clearly the anomalous finding that members of the public overwhelmingly believe that they as individuals are better prepared for an earthquake than the general public!

We believe that the significance of many of these dilemmas in public policy would fade away if authorities were prepared to involve and trust the public and to set as the goal for communication the cultivation of realistic understandings. One of the slightly encouraging signs from our investigation is that the period of waiting may have been marked by a growth of realism regarding some aspects of the earthquake threat. The unrealistic expectation of an earthquake within a year declined and with it some expressions of fear and concern, but accompanying this change was a lessening of the tendency to treat a predicted earthquake as a routine event. And while people remembered fewer earthquake warning announcements, they concentrated more on announcements from scientific sources.

Realistic understanding does not mean highly technical understanding, though we have already referred to widespread public desire for limited understanding of technical principles in terms of familiar metaphors. But it means an appreciation of the state of scientific knowledge that neither overstates nor understates the level of confidence to be placed in pronouncements concerning the earthquake threat. The same can be said of engineering knowledge and the confidence that we can place in recent advances in seismic safety design.

First reactions to a flood of realistic communications may be confusion, disparagement, and even hostility, when people have not been accustomed to realism.

Hence the goal of realistic understanding must be a long-term and continuing policy rather than a crisis-induced strategy--though even as policy innovation it may work better in an emergency than the usual patterns of information management. We recommend that:

33) The primary goal in earthquake communication should be the cultivation of realistic public understanding of the earthquake threat situation and the state of knowledge about the situation.

We have pointed out repeatedly the necessity to emphasize the implications of all communications for potential human action (See recommendation #2). Part of what makes understanding realistic is the fact that it can be related meaningfully to the selection of appropriate courses of action. Much of the confusion we encounter concerns the broader action implications of earthquake warnings and the lack of attention to the "large" problems of earthquake survival. We suspect that people sometimes take the usual earthquake survival recommendations less seriously than they might do because they seem trivial as solutions to the problem of survival in a disastrous earthquake. Against an image of the earth shaking and splitting, buildings rocking and toppling, and the sea rolling over the land, the advice to fasten a heavy mirror to the wall more securely and to store a few days supplies of food and water seems almost petty.

While we were not able to survey people's understandings of the specific risks from earthquakes as extensively as we wished in the course of our investigation, we suspect that the widespread appreciation of such focal danger spots in buildings as elevators and windows is not matched by a more general understanding of danger and safety in the larger community and appropriate survival strategies. For example, we often hear discussions of massive evacuation from the metropolitan region

as if this were either a necessary or a feasible approach to the earthquake threat. We do not believe that there is sufficient appreciation of the safety that is almost assured simply by being in an open space during an earthquake. We doubt that many people have identified the relatively safe locations near to their homes in which people could camp out with relative safety in the event of an imminent earthquake warning of the type given the residents of the Liaoning Province in China in 1975. Such realistic understandings could go far in creating the foundations upon which more credible survival programs could be given to the general public. We recommend that:

34) A major goal of public communication should be to cultivate a realistic understanding of the actual risks from earthquakes, of the locations and curcumstances subject to greatest danger, and of locations and conditions providing the greatest assurance of safety in the earthquake. Every individual should be helped to translate these understandings into specific knowledge about home, workplace, school, shopping center, and other places that are used frequently.

The cultivation of realistic understanding of the earthquake threat and the conditions of greatest danger and relative safety does not insure public acceptance of all community programs and proposed household and individual safety measures. For example, people may still question whether the danger posed by an earthquake fault classified as "active" because of fault movement over a thousand years ago is sufficient to affect human planning within the normal span of a few years or decades. Some controversy must be accepted as part of the normal political process.

But we have found that polarized conflict over earthquake safety measures is especially likely when the culmination of a long period of study and planning by government agents and technical specialists is publicly announced for the first time as apparantly a fait accompli, requiring that an unpopular safety measure be implemented on relatively short notice. Community reactions to such notifications typically display a sense of being railroaded into accepting an unpalatable decision without sufficient time to weigh its merits and to identify and weigh the merits of alternative courses of actions. Responsible authorities typically resent this reaction because they know that they have been agonizing, often for years, over what they see as a painful but inescapable decision mandated by law and the facts of the situation and in the ultimate interests of the resisters. In the polarized atmosphere members of the local community compare their situation with that of other communities and conclude that they have been singled out arbitrarily and unfairly for punitive treatment by outsiders, unfamiliar with and unsympathetic to the needs of the local community. The struggle becomes one of principle in which local communities fight a rear-guard action to preserve community autonomy from the ubiquitous encroachments of big government. This was clearly the case in Little Rock and in Ventura during the period of our investigation.

In our judgment, the strategy of withholding public announcement and avoiding public discussion until officials are convinced of the action they must take and of the evidence and the law on which it is based has not been effective in reducing the force of organized resistance or in preventing further long delays in implementing earthquake safety policies. We believe that organized resistance and delays would not be greater and would often be lessened if the public were allowed to become involved from an early stage in the long process of fact finding and

decision making. Allowed to follow the process and even register questions and opinions from the time when the question of dam safety or the possibility of a critically located active earthquake fault is first raised, crucial segments of the public have time to accept the reality of the situation and the absence of viable alternatives, or sometimes even to develop mutually acceptable alternatives. They are also able to gain perspective on the well formulated case for resistance usually developed by vested interest groups. Early involvement of the public in these processes will not lessen conflict, but we believe that in many--if not most--instances it will facilitate a more satisfactory outcome. We recommend that:

35) When a potentially dangerous situation is identified that may require implementation of an unpopular earthquake safety measure, the public should be informed from the start of the investigation, kept informed, and provided with a forum through which to register questions and concerns, so that the evidence and reasoning that lead to the eventual decision will have been in the public domain long before the decision is made. Responsible public officials should acknowledge and take constructive account of public questions and concerns throughout the decision-making process.

Involving the community in the entire process of investigating a potentially dangerous seismic condition is not merely a matter of public information and discussion. Technical expert and outsider often come to be equated in the public view of the situations. The participation of technical experts such as geologists and engineers from the local community should be actively solicited during the investigation stage. Similarly, local public officials should not be allowed to remain completely detached while the process goes on. More than perfunctory efforts to incorporate the community in this fashion should help to overcome the view that an unpalatable decision is being

unilaterally imposed from outside. We recommend that:

36) Provision should be made to insure the active involvement of locally respected technical experts and responsible officials in the investigations and decision-making leading up to the implementation of a potentially unpopular seismic safety measure.

In spite of any such program for public involvement, the significance of the proposed measures and the implications for their short-term interests will still come as a surprise for many people when the final decision is announced. Consequently it is important that the decisions be announced in their full historical context. We recommend that:

37) The historical context of technical investigation and decision-making should be emphasized in the public announcement and discussion of the need to implement potentially unpopular earthquake hazard mitigation measures.

When earthquake hazard mitigation measures are unpopular, we should recognize that they have genuinely or supposedly deleterious effects that outweigh their possible benefits in the eyes of the resisters. Especially when these measures are mandated by an agency from outside of the local community, the official spokesmen have usually made little serious investigation of these "costs" to the community. For example, Ventura residents were concerned about the effects of special study zone designation on property values, but the official spokesmen were uninformed about the actual effects on real estate values in communities where such zones had already been designated. Their lack of information and apparent lack of concern for these potential effects on the community reinforced the local sense of being oppressed by arrogant and insensitive big government.

There is a more fundamental reason why these potential local costs should be fully investigated along with the earthquake threat. The accepted format for

decisions on public policy is one that compares benefits with costs, as both are modified by some probability-of-occurrence factor. Usually the anticipated costs to the community seem more certain and more imminent than the avoidance of death, injury, and property loss in an earthquake. Often the law has been deliberately formulated so that consideration of these potential costs is left strictly to the local community. But too strict a division of responsibility is unrealistic and often counterproductive. While awareness of potential local costs should not deter state or federal officials from carrying out their mandated responsibilities, it could in some instances help them to disabuse local residents of unjustified fears, and in all instances it should facilitate mutual understanding. We recommend that:

38) Responsible officials should investigate the potential costs as well as the benefits of proposed hazard mitigation measures to the affected community, and should be prepared to supply information and answer questions of judgment contributing toward a realistic weighing of benefits against costs.

One question on which we find realistic understanding at a distressingly low level is the merit of earthquake insurance. Some population segments, such as the Mexican Americans, have almost no interest in earthquake insurance. Although most householders in southern California do not have earthquake insurance, we doubt that the negative decision is an informed one in most instances. We are mindful that even a publically subsidized program of flood insurance in flood-prone areas has attracted relatively little interest, so we hardly expect the majority of persons at risk to purchase earthquake insurance. But for those householders who wish to make an informed decision, specific information that they can apply to their own situation is not readily accessible. We recommend that:

39) Information that would allow each householder to make a realistic decision concerning the costs and potential benefits of earthquake insurance in his or her situation should be prepared and made readily available to the public.

At the risk of being repetitive, we conclude this discussion of a general policy of cultivating realistic public understanding by returning to the problem of excessive reliance on government. Emphasis on what different agencies can and should do sometimes deflects attention from the fact that the best conceived agency programs may be inoperative until the period of greatest urgency is past, and that normal communication and transportation may be disrupted for days after a great earthquake. A factory or school with its "community" of hundreds or thousands of persons may be effectively isolated for hours, and critical metropolitan lifelines may be inoperative for days. Grass roots search and rescue must begin before police, fire, and civil defense personnel can reach the affected sites if lives are to be saved. What we wish to stress is that the cultivation of realism about the great earthquake in a metropolis means recognition of the need for self-sufficiency. We doubt that most business establishments or business neighborhoods, most schools, most other places where large numbers of people congregate, or most households are prepared for the requisite level of self-sufficiency. An emphasis on self-sufficiency should complement rather than contradict the need for altruism and cooperation in an emergency. We recommend that:

40) Public policy should emphasize and facilitate preparation for self-sufficiency in the aftermath of a destructive earthquake for every household and every unit where substantial numbers of people frequently congregate.

Cultivating a network of intermediaries. We have already mentioned the need for a critical mass of local experts or opinion leaders to mediate the dissemination of information between the mass media and individual citizens. But an organized network of intermediary individuals and groups can also serve a wider range of purposes in earthquake preparedness and emergency response. It can be critically important in disseminating information, facilitating community decision-making, and fostering and guiding action.

The importance of an organized network of groups and associations to mediate between government or other vast organizations and the individual has been noted in many realms of modern life. A political party without local chapters could hardly be effective. Even maintenance of a following for a popular entertainer seems to require a network of local fan clubs. Volunteer tornado spotters organized into local units provide an indispensable complement to the work of the weather bureau in protecting communities against this disaster agent.

The organization of civil defense in the United States during and after the Second World War supplies one model. Volunteer neighborhood leaders conveyed instructions to their neighbors, helped to assess the adequacy of their preparedness (did "black-out curtains" really black light from the house at night?), relayed neighborhood questions back to higher authority, and created an important support group to help anxious individuals deal with the tensions of actual and anticipated war. A similar set of tasks must be performed if the community is to be adequately prepared for a destructive earthquake, and they can only be performed effectively and on a continuing basis by some group or organization closer to the individual than city, county, or state government. But civil defense networks no longer exist and the prospect of a great earthquake in the indefinite future has neither the urgency, the patriotic impetus, nor the range of interesting activities necessary to maintain such a special network.

The futility of relying on grass roots group formation to deal with the earthquake threat is demonstrated by the disappointing record during our study period. On the other hand, such effective or sustained group action as did occur came when some aspect of earthquake safety was seen as a natural extension or application of some other interest about which people were already organized. Piggybacking earthquake safety onto organizations with related interests insures a basis for keeping the organization going during periods when the interest in earthquakes lags.

For reaching the entire population, organization by neighborhoods should be most satisfactory, but there are few success stories for this kind of organization except in periods of deep crisis. In some communities a network of neighborhood charity-solicitation leaders might be coopted for this additional purpose,which could provide them with a welcome alternative to the usual fund-soliciting relationship with their neighbors. Neighborhood watch networks organized under police department auspices in some metropolitan communities may be well enough established to consider expanding their functions to include earthquake preparedness. But it will be necessary to incorporate both schools and established "voluntary associations" of several types into the network to achieve substantial coverage. Service organizations, youth groups, and auxiliary church groups might welcome the opportunity to reach into the neighborhood in this fashion.

Creating an effective intermediary network will not be easy, and different population segments will have to be reached in different ways. But the low level of general household preparedness for an earthquake is unlikely to be substantially improved or emergency communications adequately disseminated without some steps of this kind. We recommend that:

41) Civil Defense authorities, in collaboration with appropriate state agencies, should develop plans to involve a wide range of service-oriented community organizations into a network for disseminating safety information, fostering individual and household earthquake preparedness, and establishing a framework for neighborhood cooperation in dealing with the emergency of a destructive earthquake or an imminent earthquake warning.

Making use of the schools. Teachers and administrators at all levels readily acknowledged that most schools are poorly prepared to cope with a disastrous earthquake. Here and there local catalysts, responding on their own to the crescendo of earthquake warnings, have stimulated admirable programs. But on the whole the schools in Los Angeles County were no better prepared in 1979 than they were

in 1975 or possibly even 1970. And they had not made a measurable contribution to preparedness in the households and families of school children. We have elaborated on the problems with the schools' participation in earthquake preparedness in Part Three, Chapter Four, so we shall only briefly justify the recommendations here.

The California administrative ordinance, Title Five, Code 560, requires each school district to prepare an earthquake plan and file it with the County Superintendent, and to take certain other steps. But it is a weak and vague ordinance, easily satisfied by one-time token compliance. We recommend that:

42) The present California administrative ordinance that fixes schools' responsibilities in case of disaster should be replaced with a stronger and more specific ordinance, insuring continuing attention to earthquake preparedness and periodic review of school earthquake safety planning.

We found that few school administrators had clear conceptions of what school-community relationships might be in specific but plausible crisis situations. Community emergency plans often assume that schools will look after themselves, while school plans often assume that essential services and emergency assistance will be provided by community agencies and that vulnerable life-line systems will remain operative. Little effective attention had been given to the necessity for self-sufficiency and the state of isolation that could realistically confront schools in case of a major earthquake. We recommend that:

43) School earthquake plans should be integrated with community emergency plans, and should insure self-sufficiency in case of isolation and the disruption of life-line systems in a major earthquake.

School officials often rest in the comforting assurance that civil defense officials will take charge in an emergency and provide needed guidance, resources, and coordination. But civil defense offices are afflicted by token funding and token staffing. Personnel in schools once designated as civil defense emergency centers and stockpiled with emergency supplies often fail to recognize that these

designations are no longer operative and that stockpiles are of dubious utility after years of neglect. We recommend that:

44) School officials whose emergency plans assume that help and resources will be forthcoming from civil defense authorities should reexamine their relationship to the civil defense office and the probability of civil defense officials being able to provide needed direction, help, and resources in case of an earthquake.

We found that it was often unclear what teachere were supposed to do in an earthquake emergency, and that teachers were often untrained for some of the responsibilities most often expected of them. Few teachers are trained in first aid or briefed on the many contingencies that must be dealt with in case of an earthquake.

45) School officials should develop a set of realistic scenarios covering in specific detail the variety of ways in which a school might be affected by earthquake disaster, clarify the responsibilities of teachers under each scenario, and provide the necessary training for teachers to carry out these responsibilities effectively.

Related to the foregoing problem is the lack of standardized procedures, terminology, and signals for use in an earthquake emergency. Some emergency procedures and warning signals are ambiguous vestiges from the days of active civil defense planning. We recommend that:

46) The California State Office of Education, in collaboration with the Office of Emergency Services and the Seismic Safety Commission, should develop standard procedures, terminology, and signals for use in an earthquake emergency that are distinctively attuned to the earthquake situation.

We found neither systematic provision nor adequate resources and support systems for training children to deal with earthquake hazard at school, at home, and in the community. The subject of earthquake safety is most often introduced into

the curriculum in connection with physical science units. But teachers receive little help in presenting the human, as contrasted to the physical, side of earthquakes. We recommend that:

47) Training children to understand and deal with the earthquake hazard at school, at home, and in the community should be established as a responsibility of the schools, and appropriate resources and expert assistance should be provided to insure that the responsibility can be carried out effectively. Attention to the safety of their own homes and discussion of earthquake safety with household members should be part of the school child's training experience.

In the event of a severe earthquake or short-term earthquake warning no school plan will be viable without a clear prior understanding between school personnel and parents concerning their respective responsibilities and authority in the crisis. Because of the highly charged nature of the emergency situation, some aspects of this understanding will have to be codified into law. Since uncoordinated efforts by parents to reach their children constitute one of the most potent sources of traffic congestion and communication overload in case of an earthquake or short-term warning, these understandings must be developed in collaboration with officials responsible for coordinating community-wide disaster response. We recommend that:

48) The California State Office of Education, in collaboration with the state Office of Emergency Services, should develop a clear statement of the respective responsibilities and authority of school personnel and parents in the event of earthquake disaster or imminent earthquake warning, taking steps to insure mutual understanding of the implications of this code with authorities responsible for coordinating local community response to disaster, and insuring that the policies established are legally tenable.

Although we shall deal separately with the question of short-term and imminent earthquake warnings later, it is of some concern to us that the school

officials to whom we spoke had not given serious thought to the problems posed by a warning of imminent danger. For example, the question of whether to keep children at school or try to send them home would have to be decided on an ad hoc basis. If the warning period were a day or two, the question or whether to close the schools would have to be resolved quickly. We recommend that:

49) The California State Office of Education, in collaboration with the state Office of Emergency Services and other appropriate agencies, should develop guidelines to be followed by schools in case of imminent or short-term earthquake warnings.

Vested interest in earthquake safety. In the course of our investigation we were repeatedly impressed with the observation that while everyone believes in earthquake safety, there are few organized vested interests working for earthquake safety. Established wisdom in sociology and political science holds that sustained, resourceful, and effective action to deal with a problem situation depends upon the mobilization of vested interest groups. The absence of organized vested interest in earthquake safety and its consequences are illustrated most dramatically in the success of organized resistance to such hazard mitigation measures as enforced upgrading of unsafe buildings, draining a potentially unsafe dam, and limiting construction in a special study (active fault) zone. In each of these instances there were no vested interests to counter the well organized vested interests opposing implementation of earthquake hazard mitigation policy. On the other hand, plans for constructing the Auburn Dam in northern California were effectively suspended, and if the dam is ever constructed it will be built with much greater attention to seismic safety than was originally planned. In this case the powerfully organized vested interest in environmental protection was crucial in forcing a reevaluation of the original plans and pointing attention toward seismic risks.

The lack of vested interest in earthquake safety is also manifested in less dramatic but equally significant ways. The police force, insurance underwriters, and automobile associations all have vested interests in pedestrian and traffic safety. As a consequence, informative and appealing resource materials are available for the promotion of safety, and a cadre of experts is available to make presentations in schools, at service organization meetings, and elsewhere. Similar vested interests in fire safety insure an abundant supply of resource materials, and the availability of uniformed firemen to serve as prestigious and authoritative spokesmen for fire safety. "Neighborhood Watch" networks to combat crime would be untenable without active support and initiative from the police. There are no comparable vested interests organized to prepare resource materials and provide expert spokesmen and continuing institutional support for earthquake safety, except in some areas of construction engineering. One reason that grass roots interest in earthquake safety could seldom be sustained beyond a single neighborhood meeting may have been the lack of credible programs for sustained activity and the very limited institutional support. And we have already noted that the long delay following announcement of the Uplift before the first serious materials concerning personal and household earthquake preparedness were distributed was caused by the lack of vested interest.

The conclusion is clear, that the cultivation of vested interests in earthquake safety is important for the successful promotion of earthquake safety programs of all sorts. But doing so will not be simple. First, organized vested interests are not ordinarily established by design, but develop as unintended byproducts of other activities. For example, much of the vested interest in traffic safety came about as a byproduct of the widespread use of automobile insurance. Second, the earthquake danger is not dramatized daily by events in the way that urban crime, fire, and traffic danger are.

A possible prototype of how vested interest can be created is the recent effective community resistence to construction of an Olympic Games facility in a

San Fernando Valley flood basin. Had the flood basin area simply been left unused for flood safety reasons, the interest in exploiting the land commercially would almost certainly have insured steady encroachments into the area at risk. But the entire flood basin had been converted into a public park featuring diversified recreational opportunities enjoyed regularly by thousands of people. A vested interest in maintaining the established pattern of park development had thereby been created. Perhaps if special study zone legislation provided for public acquisition and alternative development of appropriate land for public use, similar vested interests might develop.

Considerable earthquake awareness has been promoted through the cooptation of earthquake safety by the anti-nuclear-power movement and the environmental movement. But it is doubtful that the benefits outweigh the costs in most of these instances. The credibility of earthquake risk estimates is undermined when they are used principally to support a position in an emotionally charged controversy.

An important step toward creating one kind of vested interest was taken when the State of California established the Seismic Safety Commission. It has been suggested that a byproduct of a well developed and widely used all-disaster insurance program including earthquake coverage would be the creation of a vested interest in some aspects of seismic safety.

We are not able at this stage to make precise recommendations or provide clear steps toward achieving this desirable objective. Our recommendation must therefore be limited to encouraging responsible officials to approach each new issue in short- or long-term planning for earthquake safety with careful attention to the cultivation and use of organized vested interests. We recommend:

50) Responsible officials should constantly seek to identify organized groups that might have vested interests in earthquake safety, and to devise programs in such a way as to cultivate organized vested interests in earthquake safety.

A comprehensive package approach. Like many other problems, earthquake safety is usually approached in a segmented fashion. The building inspector who finds an apartment building unsafe knows nothing of the economics of low-priced housing for residents who may be displaced. The scientist who has information justifying an earthquake prediction or near prediction often shares belief in the popular mythologies concerning human response to warnings. And the engineer who finds a dam unsafe knows nothing of the significance of the dam in local community sentiment. Because specific hazard mitigation proposals and broader programs are usually designed by specialists and specialized agencies whose view of the problem is segmental, public officials often find themselves saddled with proposals that solve one set of problems by creating or exacerbating other problems.

Our concern with the need to approach problem situations comprehensively rather than segmentally was stimulated especially by instances in which the implementation of earthquake hazard mitigation measures provoked organized resistance and popular misunderstanding. In each of these instances, no provision had been made to soften the impact on those persons who would indubitably suffer hardship as a result of the proposed safety measure. Following the traditional segmented and specialized approach, a team of hazard experts identifies the flood or earthquake or other hazard and suggests an appropriate course or courses of action to alleviate that danger. But they pay no attention to the fact that these solutions may create or augment other problems that may be as serious or more serious than the natural hazard in question. If, for example, there is an unsafe dam, and the indications are that the dam should be drained of water, the hazard assessment team ought also to identify in a comprehensive way the effects of draining the dam on the life of the community. Where will they secure their water, and will the water be more costly than heretofore? What segments in the community may lose their livelihood if the dam is drained? Of what historical and symbolic significance is the dam to the

local community as a representation of the community's self-reliance and resourcefulness?

A makeshift way of dealing with this situation is to require an environmental impact report. But this step is often seen principally as a delaying action and contributes to a disputatious relationship rather than one of comprehensive planning. Agencies generally deny responsibility for the unintended consequences. Promises were made in Los Angeles City Council that funds would be sought to provide low-cost loans for upgrading seismically unsafe structures, but no such funds were ever located or made available.

First and foremost, we recommend that:

51) A community seismic hazard assessment should include an examination of the total problem, specifying the possible solutions, the likely social and economic impact of each of these solutions, and the steps required to offset deleterious consequences of solutions to the earthquake hazard problem. Whenever feasible a hazard mitigation program should be a complete package dealing realistically with the hardships created by the hazard mitigation measures.

The focal point for earthquake hazard mitigation activity is the local community. Yet local communities usually lack the resources to deal with earthquake risk in a comprehensive way. Nor do they generally have the technical experts needed to make accurate assessments of seismic hazards or the social and economic implications of hazard mitigation. Extensive support and initiative from the state and federal government are essential. Hence the comprehensive package approach to any seismic safety problem situation must begin with technical assistance to local communities in the assessment of seismic hazard and the identification of social and economic consequences of hazard mitigation measures and ways of dealing with them. We recommend:

52) Through their respective coordinating agencies, state and federal government

should make technical assistance available to local communities as a comprehensive package including hazard assessment, technological assistance, and social and economic impact assessment and amelioration technique.

The third item in the package should be an emphasis on local initiative. We are living in an era when there is increasing resistance to the encroachment of Big Government on the individual, the family, and the small community. Whatever we propose must be sensitive to this current climate. The theme of defending the local community from an Orwellian "big brother" played a prominent part in resistance to hazard mitigation efforts during our study period. It is important, then, that the package be offered rather than imposed on local communities. It should be offered in the form of technical assistance, a model plan, and matching resources of some kind, for a local unit that will actually take the initiative and the central responsibility for conducting the hazard assessment and full impact analysis, and for developing proposals for corrective action.

The ultimate evaluation of any social program is a matter of values. We know that all segments of the American population do not hold identical values, that small cohesive communities are especially likely to develop distinctive values, and that the professional who examines a problem impersonally and the involved layperson can never see the same situation in exactly the same way.

We recommend that:

54) Whenever it is feasible, the final responsibility for designing, adopting, and implementing a comprehensive earthquake hazard mitigation package should be retained by the local community, with proposed packages offered to local communities by state and Federal government rather than imposed on them.

A fourth element in a comprehensive package is the assurance of support for a reasonable hazard mitigation program, including support for those aspects of the program that are intended to offset the potentially counterproductive consequences of the solutions to the hazard. For example, if something has to done about substandard

buildings, and these buildings serve primarily economically marginal groups in the community, there will probably have to be some kind of federal or state subsidy built into the package to insure that the upgraded structures or the replaced structures are still financially accessible to the same segments of the population, and that residents will not be driven off into even less satisfactory quarters. We recommend that:

54) A comprehensive earthquake hazard mitigation package should include whatever financial subsidy or other fiscal provision is necessary to protect against undue hardship or inequity as a consequence of implementing the hazard reducing components of the package.

Finally, the fifth element in this total package approach would be an emphasis on providing positive incentives for the implementation of hazard mitigation plans. As it now stands, we know that it is easier to come up with negative incentives than positive incentives, since negative incentives usually cost the agencies less. We know also that there are unintended negative incentives built into our system. For example, the moment a building owner upgrades a structure, his property taxes are increased. If the effect of upgrading the structures is to increase the potential for realizing income from the structure, the tax increase is not in the long view a negative incentive. But if it does not increase the earnings from the structure, or if it does so only at the cost of exacerbating housing or other problems for the former users, then the incentive is clearly a negative one, and should be offset and replaced by positive incentives. We recommend that:

55) Careful study should be given to identifying and using positive incentives for cooperation in a comprehensive earthquake hazard mitigation program, and to reducing when possible the disproportionate dependence on negative incentives.

Adjusting the approach to the population. As we examine the evidence concerning vulnerability to earthquake hazard and public awareness, it is tempting to form an image of the typical citizen in a typical situation. This kind of image is important in helping to set priorities. But it is dangerous if we yield to the temptation to disregard the variety of situations and the heterogeniety of human responsiveness concealed by the composite image. While it is often beyond the province or capability of public agencies to design programs that are flexibly attuned to individual idiosyncracies, the systematic differences between ethnic and racial groups, socioeconomic groups, and age groups cannot be overlooked. For example, public officials may take note of our finding that the general public thinks more of hazard mitigation than of emergency response when reflecting on government responsibility. But they could be seriously mislead if they did not also remember that it is in just some of the most vulnerable neighborhoods in case of an earthquake that people place relatively more emphasis on emergency response and less on hazard mitigation.

In many communities, housing and workplaces for the poor, elderly, and minorities are disproportionately concentrated in neighborhoods where old and unsafe buildings abound. This is especially true in California, where the older buildings have been demolished and replaced in the more affluent neighborhoods, and where post-1933 construction is more likely to include some element of seismic resistance in its design. It is well known that the vulnerable central city district of San Francisco (the "Tenderloin"), where row after row of unreinforced masonry roominghouses and hotels are located, is also an area with a large population of relatively poor, elderly persons. It was also brought out that in Los Angeles, Blacks were particularly likely to be displaced by enforcement of the ordinance requiring evacuation of unsafe buildings that are not brought up to standard.

It is true that in many communities, particularly in the East, the well-to-do may live in vulnerable brick structures because this type of construction is best suited to the more common hazard of inclement weather. However, it is still true that once they are alerted to the problem, the relatively well-to-do populations and the younger people who have many years of peak earnings ahead of them can better afford to underwrite the costs of upgrading unsafe structures than can the elderly and the disadvantaged. We have a problem calling for federal assistance in large part just because of the fact that the costs of bringing seismic risk down to a satisfactory level are often especially high in those neighborhoods where the owners, the tenants, and the customers are least able to underwrite the costs themselves.

Furthermore, our economy works so that it is just because buildings are below standard that the poor can afford to use them, either as residences or as places of work or as places to do business. Any of the ordinary arrangements whereby the costs of upgrading the structures are amortized and eventually charged to the users will simply reduce the supply of structures available to the elderly and the economically disadvantaged. Furthermore, the owner of one of these structures in a deteriorated neighborhood who invests money into his building can look forward both to losing some of his current tenants who can no longer afford the costs and, because of the deteriorated nature of the area, being unable to attract a new clientele to replace them.

Because of the central fact of inequity, two of the usual approaches to problems of this sort are not very helpful. The first approach is regulation and policing. In the relatively well-to-do neighborhoods, if building owners are notified that their structures are unsafe and are provided with some minimal guidance and assistance, they can normally afford the costs of upgrading or replacing the structures, with the assurance that future income will absorb the

costs. In the poorer areas, this is not the case, and no amount of upgrading of individual structures is likely to increase the revenue sufficiently to offset costs during the foreseable lifetime of the building. For similar reasons, the positive incentive of offering tax credits is likely to be insufficient to enable the owners of substandard buildings in deteriorated areas to cover the costs of bringing the buildings up to standard. We are likely to see only more of the wholesale abandonment of buildings that already plagues some of our American metropolises. And even if these incentives should work and structures be upgraded, the effect would still be to reduce the supply of housing and building structures accessible to the poor.

We could summarize this general point by saying that there is a serious danger that, in thinking about earthquake hazard mitigation, we will think too much in terms of the problem as it confronts the middle-class homeowner or the owner of a business that caters to middle-class customers. For this population the problem exists, but it is likely to be of manageable proportions, and the government's role is primarily that of prod and facilitator. But the more serious problem concerns those populations for whom the problem is greatest and the resources available are least. We must approach earthquake hazard mitigation with full recognition that this latter group requires the most attention. We recommend that:

56) Special attention should be given to the vulnerability of neighborhoods where the poor and the elderly are concentrated, and to providing alternative resources for persons unable to take advantage of the usual means for dealing with earthquake risk.

Even when groups do not differ in their vulnerability, their cultural traditions and their systems for communication and social support may differ suffciently that programs must be organized differently to have optimum effect.

Our comparison of Black, Mexican American, and White Anglo patterns has suggested different principles of community organization. Whites are more often integrated into the community through organizational memberships, while Mexican Americans are more often integrated through immediate and extended family networks. Older Whites are more likely than older Blacks or Mexican Americans to live alone. The church role is unusually pervasive among Blacks. It will be necessary to overcome widespread skepticism about predicting earthquakes and fatalism about the consequences of earthquakes among Blacks. In contrast, a more optimistic and even unrealistically positive attitude may prevail among many Mexican Americans.

We have spoken earlier of the need to adjust communication to the distinctive characteristics of different populations. We now offer the recommendation in more general terms:

57) Planning for earthquake safety and implementation of programs should be done flexibly with attention to the distinctive cultures and social systems of ethnic and racial groups, and with full involvement of sensitive and respected spokesmen and spokeswomen from these communities.

At the risk of repeating an earlier recommendation, we round out this discussion of flexibility in dealing with subcommunities having different needs and resources by calling attention to the importance of spontaneous altruistic grass roots service at the time of disaster. When disastrous effects are obvious and visibly shared, and the community has not been previously riven into factions, the altruistic response may emerge fairly automatically. But when the plight of those in special need is not immediately obvious, a greater prior sensitization on a personalized basis may be necessary if the altruistic response is to be forthcoming. Repeating and elaborating on recommendation 20, we recommend that:

58) Earthquake planning should include special efforts to create general awareness of the distinctive problems of unusually vulnerable groups

in earthquake preparation, in responding to earthquake warning, and at the time of an earthquake and following. Efforts should be made to personalize the awareness of vulnerable groups, and to familiarize the community with ways in which help can be provided by grass roots action.

Preparing for the short-term earthquake warning. In discussing earlier the misplaced concern over potential economic dislocation in case of a long-term earthquake prediction (recommendation 10), we expressed doubt that long-term earthquake predictions would be issued with sufficient certainty to provoke massive social and economic readjustments, within the foreseeable future. We must recognize that before any prediction or near prediction is issued, southern California residents already recognize that they live in "earthquake country." They have come to terms with a risk that is unspecified as to time and place through such practical means as accepting seismic safety standards in their building codes, and psychologically by such devices as comparing their lot to that of populations subjected to much more frequent tornado, hurricane, flood, or winter storm danger. Unless the time and place of impact of a forecasted quake are specified quite precisely, very little additional social and economic adjustment is likely beyond the subtle maturations in awareness that our investigation has revealed. The identification of seismic gaps and recurrence-cycles cannot supply the needed precision in a region like southern California where major earthquakes are relatively infrequent occurrences. The one-time hope that a consistent pattern of multiple precursory signs that develop in an orchestrated fashion would provide the basis for confident and precise long-term predictions is now seriously questioned. The current southern California situation in which some seismologists forecast a great earthquake within twenty years with a fifty percent probability, or the Japanese situation in which the great Tokai earthquake has been forecasted within ten or twenty years with 80 percent probability represent currently applicable models for long-term forecasting.

Identification of zones where the risk of destructive quakes within a decade or two is disproportionately high remains one of the most essential tasks for applied earthquake research. Both physical and socioeconomic monitoring and planning activities can be concentrated in high risk zones, rather than spread thinly over the entire earthquake-prone region. This practice is one of the kingpins in the Chinese prediction program, and is being followed in Japan now. A major thrust in several of our recommendations has been that a well organized program of public information and organizational activity, based on the continuing research and intensified governmental planning that should be instituted when a region like southern California is designated as subject to heightening earthquake risk, can greatly enhance public preparedness for an earthquake.

But the emphasis on economic disaster in the wake of an improbably precise long-term prediction has been a red herring, diverting attention away from the more realistic problems of coping with a short-term warning. There is no assurance, of course, that a short-term imminent warning can be issued before a destructive earthquake occurs. After successfully issuing warnings a few hours before each of several disastrous quakes, the Chinese were unable to issue such a warning before the most disastrous Tangshan quake of July 1976. But a converging escalation of varied premonitory signs may provide a fairly reliable basis for issuing warnings a few minutes, hours, or days before occurrence of a potentially disastrous earthquake in some instances. Japanese planning for the Tokai earthquake has been based on the assumption that a short-term warning can be issued.

In light of the realistic possibility for short-term warning, public awareness and government planning are woefully inadequate. The kind of problem we might confront is dramatically highlighted in recent Japanese research. Responses to a hypothetical scenario indicated that the urban response to a short-term warning issued with high credibility will be a massive movement of population, not to

leave the area in panicy flight, but to bring family members together into common locations. The immediate effect will be to block the streets and clog all normal channels of communication. Our more limited experience with neighborhoods and schools that have been threatened by brush fires can easily be extrapolated to demonstrate that the problem is not unique to Japan. On the other hand, many more southern Californians than Japanese residents--especially White Anglos--live in one- or two-person households, and we know little of how this fact would affect population movement.

But even before we think of the consequences of short-term warnings, we must face the fact that there is no generally recognized procedure for issuing a short-term warning, so that it could reach most of the people promptly and be recognized for what it was. And if the warning were issued and did reach most people, very few people have any idea what they should do, depending upon their location upon receipt of the warning. As we have observed, knowledge of what to do when an earthquake strikes is widely diffused. But comparable attention has not been given to constructive use of short-term warning time.

Planning will have to involve difficult decisions about the "grace" period available. If there is time for families to be assembled, the family unit remains the most dependable support group for most people, and the unit most capable of establishing short-term self-sufficiency. If there is no assured period of grace, advance planning and emergency communications must be such as to allay the intensified anxiety that occurs when family members must face disaster separately.

This extended discussion is intended to underline the complexity of planning for short-term earthquake warnings and the urgency of doing so. We consider this to be a critically important recommendation:

59) Major attention and resources should be devoted to developing plans

for issuing and responding to short-term and imminent earthquake warnings. Plans under various contingencies should be developed for schools, workplaces, and other locations where people congregate. Households and families should be treated as the natural units in planning. The public should be well informed about relevant organizational plans, and each household should be encouraged and helped to develop plans appropriate to their unique circumstances but fully coordinated with organizational plans.