

RR NO.

10879

v. 1

REPORT TO THE CONGRESS

DISASTER PREPAREDNESS

EXECUTIVE OFFICE OF THE PRESIDENT

OFFICE OF
EMERGENCY
PREPAREDNESS



HV
555
U6
A46

JANUARY 1972

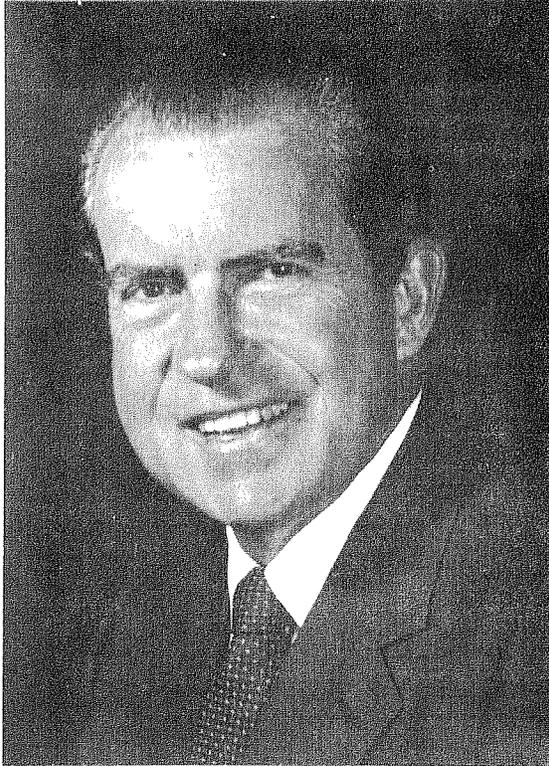
VOLUME ONE

sta # 4472

RR# 10879

v. 1

Volume One
DISASTER PREPAREDNESS



“... we will seek to set clear and intelligent targets for research and development, so that our resources can be focused on projects where an extra effort is most likely to produce a breakthrough and where the breakthrough is most likely to make a difference in our lives. Our initial efforts will include new or accelerated activities aimed at . . . reducing the loss of life and property from earthquakes, hurricanes and other natural disasters . . .”

*President Richard Nixon
“State of the Union”
January 20, 1972*

Report to the Congress

DISASTER PREPAREDNESS

Executive Office of the President
Office of Emergency Preparedness

January 1972

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF EMERGENCY PREPAREDNESS
WASHINGTON, D.C. 20504

OFFICE OF THE DIRECTOR

Honorable Spiro T. Agnew
President of the Senate

Honorable Carl Albert
Speaker of the House of Representatives

Sirs:

I am pleased to transmit to the Congress the enclosed report on Disaster Preparedness in response to Section 203(h) of Public Law 91-606.

The report reflects a comprehensive study of the types of major natural disasters experienced in the United States and offers findings and potential solutions to prevent or minimize the loss of life and damage to property. In the preparation of the study, careful consideration has been given to the views of Federal agencies, State and local governments, professional and trade associations, research and academic institutions, private volunteer organizations, and individual experts. The final analysis and findings, however, were developed independently by an Office of Emergency Preparedness Disaster Study Group under my direction.

The main thrust of this report points to the need for improvement in disaster preparedness at all levels. The findings contain potential initiatives for moving further toward an improved, concerted national disaster preparedness program. I commend them to the attention of the Congress; however, they should not be viewed as specific proposals for legislation or funds.

I am providing the report to all Federal agencies having an interest in the findings, with a request that each agency consider those pertinent to its responsibilities in the preparation of present and future programs. I have requested that these agencies keep my office informed of actions related to the findings, so that we may have a systematic record of progress in the field of disaster preparedness.

Respectfully,


G. A. Lincoln
Director

Enclosure

Acknowledgments

This report to the Congress has been prepared by the Office of Emergency Preparedness PL 91-606 Disaster Study Group. The Study Group was appointed by George Lincoln, Director, Office of Emergency Preparedness, and operated under the general supervision of George Grace, Assistant Director for Disaster Programs.

Authors of Volumes One and Three were Frank Bourgin, Rutlage Brazee, Charlene Dougherty, Gerald Fauss, Don Hammonds, Warren Hannum, Frank Isemann, Richard Letaw, Francis Manda, Philip McIntire, Charles McIntosh, Ugo Morelli, Marshall Sanders, Raymond Stralka, and Robert Schnabel. Preparation of Volume Two was directed by Frederick Zimmermann for the Council of State Governments. Its inclusion in this Report is not necessarily an endorsement of all its particulars.

Editors of the report were Ernest Atkin, Douglas Brown, Don Carbone, Francis Manda, Ugo Morelli, Marshall Sanders, and Robert Schnabel. The following reviewed and commented on the manuscript: William Crockett, George Grace, Raymond Karam, James Lewis, Haakon Lindjord, and Spence Perry.

Other members of the Study Group who conducted research and analyses were: Irving Goodman, Nancy

Irwin, Charles May, Beverly Rosenberg, Michael Tansey, Stephen Teichler, Timothy Vanderver, and Forrest Waller. Special mention is due Helen Makuck, who served as my administrative assistant.

Consultants to the Study Group were Charles Fritz (National Academy of Sciences and formerly with the Institute for Defense Analyses), J. Eugene Haas (University of Colorado), and Karl Steinbrugge (University of California, Berkeley).

Contributing to the study were more than a hundred Federal agencies, State and local governments, professional and trade associations, and volunteer disaster relief organizations. Specific contributing organizations are gratefully recognized and acknowledged below.

While the report largely reflects the substantial contributions of the many participants, the final analyses and findings of the report are attributable to the Study Group alone.

Robert E. Schnabel
Director, Disaster Study Group
Office of Emergency Preparedness

January 1972

Contributors to the Study

Federal Agencies

Executive Office of the President:

Office of Science and Technology
Office of Telecommunications Policy

Department of Defense:

National Communications System
Department of the Army
Office of Civil Defense
Corps of Engineers
Department of the Navy
Department of the Air Force
Civil Air Patrol

Department of the Interior:

Office of the Deputy Assistant Secretary for Territorial Affairs
Office of Oil and Gas
Geological Survey

Bureau of Land Management
Bureau of Reclamation
Bonneville Power Administration

Department of Agriculture:

Farmers Home Administration
Forest Service
Rural Electrification Administration
Soil Conservation Service
Food and Nutrition Service
Agricultural Stabilization and Conservation Service
Federal Crop Insurance Corporation

Department of Commerce:

Bureau of Domestic Commerce
Economic Development Administration
Maritime Administration
National Bureau of Standards
National Oceanic and Atmospheric Administration

*Department of Labor**Department of Health, Education, and Welfare:*

Public Health Service
 Food and Drug Administration
 Health Services and Mental Health Administration
 Office of Education
 Social and Rehabilitation Service

Department of Housing and Urban Development:

Federal Housing Administration
 Federal Insurance Administration

Department of Transportation:

Office of Emergency Transportation
 U. S. Coast Guard
 Federal Aviation Administration
 Federal Highway Administration

Atomic Energy Commission
 Environmental Protection Agency
 General Services Administration
 Interstate Commerce Commission
 National Aeronautics and Space Administration
 National Science Foundation
 Small Business Administration

Smithsonian Institution:

Center for Short-Lived Phenomena
 Science Information Exchange

Tennessee Valley Authority
 Federal Council for Science and Technology, Interdepartmental Committee for Atmospheric Sciences

National Academy of Sciences—National Academy of Engineering—National Research Council
 (Including 31 Boards and Committees)

State and Local Agencies

Alaska State Housing Authority
 Council of State Governments
 County of San Diego
 National Association for Port Authorities
 National Association of Insurance Commissioners
 National Association of State Foresters
 National League of Cities
 National Waterways Conference
 Port of Cleveland
 U. S. Conference of Mayors

Institutions and Associations

American Association of Blood Banks
 American Association of Public Health Physicians
 American Chemical Society
 American College of Surgeons
 American Congress on Surveying and Mapping
 American Forest Institute

American Forestry Association
 American Geological Institute
 American Geophysical Union
 American Hospital Association
 American Institute of Medical Climatology
 American Insurance Association
 American National Standards Institute
 American Nuclear Society
 American Psychiatric Association
 American Public Welfare Association
 American Public Works Association
 American Society of Agricultural Engineers
 American Society of Civil Engineers
 American Society of Planning Officials
 American Society of Safety Engineers
 American Veterinary Medical Association
 Association of American Railroads
 Associated General Contractors of America
 Edison Electric Institute
 Forest Industries Radio Communications
 Independent Natural Gas Association
 Institute of Makers of Explosives
 Legislative Council for Photogrammetry
 Manufacturing Chemists' Association
 Mobile Homes Manufacturers Association
 National Air Tankers Association
 National Association of Fire Investigators
 National Association of Independent Insurers
 National Association of Insurance
 National Conference of Standard Laboratories
 National Council on Radiation Protection and Measurements
 National Forest Products Association
 National Geographic Society
 National LP-Gas Association
 National Safety Council
 National Society of Professional Engineers
 National Waterways Conference, Inc.
 Rachel Carson Trust for the Living Environment, Inc.
 Reinsurance Association of America
 Structural Engineers Association of Southern California
 Transportation Research Foundation
 U. S. Committee on Large Dams of the International Commission on Large Dams
 U. S. Independent Telephone Association
 Urban Land Institute
 Water Pollution Control Federation

Volunteer Disaster Relief Organizations

The American National Red Cross
 The Salvation Army

Contents of the Report

Volume One

Letter of Transmittal	v
Acknowledgments	vii
PART I. INTRODUCTION	1
PART II. SUMMARY OF FINDINGS	3
PART III. DISASTER PROTECTION	7
Chapter A. General Measures	9
Chapter B. River Floods	15
Chapter C. Tornadoes and Windstorms	35
Chapter D. Hurricanes and Storm Surges	47
Chapter E. Forest and Grass Fires	57
Chapter F. Earthquakes	73
Chapter G. Landslides	87
Chapter H. Tsunamis	91
Chapter I. Volcanoes	103
Chapter J. Frosts and Freezes	107
Chapter K. Droughts	115
PART IV. DISASTER MITIGATION	123
Chapter A. Land Use and Construction	125
Chapter B. Disaster Insurance	135
Chapter C. Weather Modification	147
PART V. APPLICATION OF SCIENCE AND TECHNOLOGY	153
Chapter A. Research	155
Chapter B. Evaluation	161
PART VI. HISTORICAL DATA	165
Chapter A. Disaster Legislation	167
Chapter B. Selected Statistics	175
Bibliography	185

Volume Two

PART VII. EXAMPLE STATE DISASTER ACT OF 1972 1

Volume Three

PART VIII. PHYSICAL STUDIES 1

- Chapter A. River Floods 3
- Chapter B. Tornadoes and Windstorms 27
- Chapter C. Hurricanes and Storm Surges 39
- Chapter D. Forest and Grass Fires 53
- Chapter E. Earthquakes 71
- Chapter F. Landslides 89
- Chapter G. Tsunamis 99
- Chapter H. Volcanoes 115
- Chapter I. Frosts and Freezes 123
- Chapter J. Droughts 133

NE

PART I

INTRODUCTION

On December 31, 1970, the President signed Public Law 91-606, the Disaster Relief Act of 1970. In addition to providing for a comprehensive program of assistance in major disasters, the Act, in Section 203(h), directed that a full and complete investigation and study be conducted to determine what additional improvements could be made to prevent or minimize the loss of life and property due to major disasters.

The President in his State of the Union Message to Congress on January 20, 1972, did state that the Administration's efforts for marshalling science and technology will include new or accelerated activities aimed at reducing the loss of life and property from earthquakes, hurricanes, and other natural disasters. The expanded activities, as set forth in the President's FY 1973 budget, stemmed from a major review by the Administration during the past year of the problems and opportunities for American technology.

This report by the Director of the Office of Emergency Preparedness is in response to the Congressional requirements in PL 91-606; it has drawn significantly on that Administration review and is a contribution to the disaster preparedness program outlined in the State of the Union Message.

The report was prepared by an *ad hoc* study group appointed by the OEP director, George A. Lincoln. The study group conducted an intensive analysis of the nature of natural disasters occurring in the United States and the programs, both governmental and private, for protecting life and property in disasters. The report reflects contributions by and consultations with Federal, State, and local agencies; professional institutions, associations, and experts; and private volunteer disaster relief organizations. The findings are those of the Director of OEP.

Ten types of natural disasters are examined in this report: river floods, tornadoes and windstorms, hurricanes and storm surges, forest and grass fires, earthquakes, landslides, tsunamis, volcanoes, frosts and freezes, and droughts. Their causes, effects, and occurrences and the means for coping with them are discussed in the 10 chapters comprising Part VIII and published in Volume Three. These chapters are intended to provide a fuller appreciation of the differences among the various phenomena and specific disaster occurrences. The prob-

lems posed by these disasters, together with the associated countermeasures, reflect these differences.

Reprinted in Volume Two as Part VII of this report is the *Example State Disaster Act*. It consists of model legislation, with an Introduction and section-by-section Commentary, prepared by the Council of State Governments especially for this study. It is a product of the Council's detailed evaluation of disaster preparedness in each State and separate jurisdiction. The Example Act is also the subject of a special Council of State Governments report, *1972 Suggested State Legislation*.

The suggestions by the Council for legislative action to eliminate shortcomings in State and local disaster preparedness complement nationwide measures at the Federal level.

Volume One, organized into six parts and 18 chapters, contains the analyses and findings of the study with regard to the current status and the possibilities for improvement of disaster preparedness throughout the Nation.

Following this Introduction (Part I), a Summary of Findings (Part II) covers the general conclusions of the study. It stresses the overall theme of partnership among Federal, State, and local governments in achieving improved disaster preparedness and presents major findings relevant to the roles of government, science, and the public.

Part III consists of 11 chapters on Disaster Protection based upon vulnerability prevailing in the United States. One chapter deals with general measures applicable in all cases; the others deal with the specific measures for each of the 10 types of disasters covered in this study. Particular attention is given to (1) vulnerability, (2) prediction and warning capabilities, (3) preventive measures, and (4) preparations and readiness for governmental and public response to disasters. Considerable disparity exists among the types and frequencies of disasters and among the requirements and capabilities of the States and localities. However, several exemplary localized measures are highlighted for wider application.

Part IV, three chapters under the heading of Disaster Mitigation, concerns measures which may be taken to reduce the vulnerability of life and property to natural disasters. Regarding land use and construction, these are relatively long-term measures aimed at stricter local

regulation to bring about greater hazard reduction. Disaster insurance is examined in connection with hazard reduction objectives; it is found to be a potential incentive under certain conditions but a disincentive under others. Also discussed is the Federal Government's role in weather modification to avert or dissipate certain disaster-causing phenomena.

The application of science and technology is covered in the two chapters of Part V. These examine the forms and sources of disaster research, identify its potential contribution to disaster preparedness, and establish and amplify the relationship between research and evaluation. The importance of on-the-scene evaluations and postdisaster critiques is highlighted.

Included also are two chapters (Part VI) summarizing disaster legislation and program statistics: Volume One concludes with a bibliography of source materials used in the study.

In summary, this report establishes a broad-based and comprehensive analysis of disaster preparedness in the United States. While more intensive study is needed in several areas, a start has been made towards better preparedness. The Office of Emergency Preparedness has, as one of several steps, established a Disaster Preparedness Division to participate with other agencies in the implementation of a coordinated and concerted national program. To succeed, that program must have the support of the scientific and engineering professions, government at all levels, and the people.

PART II

SUMMARY OF FINDINGS

This part presents in summary form the major findings of the study. The more detailed findings appear in each chapter of Parts III, IV, and V.

Vulnerability Analysis

Vulnerability analysis is a prerequisite to effective disaster preparedness. The variety in types and frequency of natural disasters and the differences in effect and damage make it clear that an assessment of vulnerability must be made for each community as a first step in formulating regulations, plans, and programs to reduce hazards and prepare for disasters.

The assessment of vulnerability to river floods is well advanced, but investigation shows that improvements can be made by producing risk maps of a more useful scale and by increasing the pace of information and mapping programs. A program for risk mapping in selected hurricane-prone areas has been initiated and should be continued.

General areas vulnerable to tsunamis, ocean waves generated in the Pacific by earthquakes, are known, but there should be a further effort to prepare risk maps delineating the reasonably expected limits of inundation, particularly for populated coastlines.

Populated areas with high probability of earthquakes need increased seismic instrumentation to gain more knowledge of earthquake phenomena. With knowledge and seismic data, specific areas of vulnerability can be delineated, and a program of risk mapping can be pursued as an essential first step in developing preparedness plans and land-use and construction standards.

There is a need to encourage prudence in agricultural practice and in community development in those areas where recurring vulnerability to forest and grass fires, frosts and freezes, and droughts is well known. Vulnerability analysis should be taken into account before land development begins.

Over half of the population of the United States is located on or near its coastlines, and the percentage is increasing. These areas are the most vulnerable to catastrophic disasters—earthquakes on the West Coast and hurricanes on the Gulf and East Coasts—and are therefore being systematically analyzed to determine

vulnerability and to develop specific and realistic preparedness plans.

As populations become larger and more concentrated, timely and safe evacuation under threat of hurricane, flood, tsunami, or fire will become increasingly difficult. Officials responsible for population centers in high-risk locations must consider the expected warning time and the capability of evacuation routes to handle traffic that would be caused by mass evacuation.

The number of persons who must evacuate would also be determined, in part, by the shelter and protection available in the threatened area. For protection from hurricanes, floods, and tornadoes much more can and should be done to identify available public shelter and to provide for shelter in new construction.

Prediction and Warning

The value of past investment in prediction and warning capabilities is clearly demonstrable. Despite the increasing property losses, there has been a notable decline in lives lost when such capabilities have been established and used, notably for hurricanes and tornadoes. There is, however, considerable variation in capability within both the earth and the atmospheric sciences for predicting the occurrence of disaster-causing phenomena.

In the atmospheric sciences, despite substantial progress, there is still need for better understanding of the causes and mechanics of hurricanes and tornadoes. With new knowledge and improved methods, hurricane predictions can be significantly more accurate as to cause, landfall, and force. Emergency protection and evacuation, with such improvements, could be taken with greater confidence and thoroughness. Similarly, improvement should be sought in predicting the likelihood of tornadoes, as well as in detection and warning when these sudden phenomena do occur.

Precise prediction and warning of the timing and extent of earth disturbances—earthquakes, volcanoes, and landslides—and earthquake-generated tsunamis are not currently feasible, although the potential for such disaster in many areas is known. More instrumentation for monitoring and detecting dynamic forces within the

earth's mantle is needed to enable better understanding of these phenomena and formulation of a theory and system for prediction and warning. While progress has been made in instrumentation for earth disturbances, it has not been comparable to the progress in monitoring the atmosphere.

Since the possibility of discovering tsunami waves generated by a distant earthquake is quite good, the well-conceived, existing tsunami warning system can be significantly improved with relatively minor investments in sensors and communications. The data thus derived will further the needed research on tsunami phenomena and improve predictions of wave height and landfall.

Certain types of disasters, such as river floods, droughts, and forest and grass fires, are presaged by discernible weather factors and changes. Similarly, hurricane and tornado seasons can be anticipated. For many of these frequently recurring natural threats, the general conclusion is that existing prediction and warning systems are sound but require extension and modernization. The pertinent chapters describe the additional facilities, equipment, sensors, and communications, together with associated staffing, to improve detection of disaster-causing phenomena and enhance public warning.

Of the many problems in warning dissemination, the most obstinate is that of speedily warning each endangered individual, particularly for tornadoes and flash floods. A need exists for warning systems capable of being extended directly into every home and operating 24 hours a day to protect life in sudden disasters.

Public Information

Public awareness of the threats posed by the various natural disasters is essential to preparing for them and reducing their destructive effects. This awareness can be achieved by making information about disasters—and what to do if one occurs—readily available and easily understandable. Where appropriate, information campaigns should coincide with the peak time for “seasonal” occurrences, such as hurricanes, tornadoes, floods, and fires. However, knowing about the hazards and what to do in the event of a disaster provides only limited assurance that an individual will respond on the basis of his knowledge. Governments and individual citizens, therefore, have a shared responsibility to create conditions more likely to assure public responses that will reduce losses to life and property.

It was found that the public responds most readily to those sources of information that are used routinely and frequently, such as radio, television, newspapers, and the telephone book. For example, one page in the telephone book for Oahu provides a risk map and tells what to do in the event of a tsunami. This simple but effective procedure can be applied nationally for other types of disasters.

Disaster Legislation

The reduction of hazards and preparedness for disasters are government responsibilities as well as the concerns of every citizen. For this purpose, there must be, in keeping with the Nation's Federal system, appropriate disaster legislation for all levels of government. Only in this way can effective community and nationwide programs be realized. Legislation is required to regulate land-use and construction standards, to provide authority for prompt and effective emergency response, and to assure cooperation and assistance among government jurisdictions. In the past the emphasis was on postdisaster assistance; in the future it should be on predisaster preparedness. This theme is expressed throughout the Council of State Governments' *1972 Suggested State Legislation*. It is also stressed throughout this report.

Disaster Plans

Planning is essential for any region or community likely to be affected by a disaster, in order to determine what preventive and protective measures can and should be taken before and at the time of a disaster. Planning requires cooperation from all levels of government. A prerequisite to such planning is a determination of vulnerability of a given area to particular types of disasters. In this regard, Federal agencies are helping—and can do more to assist—the States and local governments.

State disaster planning is found to be uneven in coverage and quality. It should, above all, be more concerned with the needs of local communities, with greater emphasis on preparedness or predisaster actions. Model or pilot plans, applicable to specific regions and types of disasters, have proved to be useful and should be used more widely.

The greatest need is at the local level, and several Federal efforts are aiding in this regard. The Corps of Engineers, for example, has been helpful to local communities with regard to flood preparedness, as has NOAA in connection with hurricanes and tornadoes. More recently, OEP has given an assignment to the Office of Civil Defense in the Department of the Army to assist in the development of local disaster preparedness.

To be confident that disaster planning is preparing government officials, volunteers, and the public to cope better with disasters, such plans must be exercised and evaluated. This is becoming a standard practice.

Emergency Operations

It is important that government emergency response to natural disasters be accomplished through existing organizational arrangements, augmented as necessary

This approach should result in greater identification of government officials with their constituencies during times of extraordinary need. It is a logical extension of governments' dealings with the day-to-day emergencies.

The main focus of emergency response to major disaster should be: (1) to expand routine emergency services, such as police, firefighting and sanitation; (2) to provide those things which the individual citizen takes care of by himself in normal times but which have been interrupted by the disaster, such as food, housing, and personal welfare; and (3) to make special provisions for medical care.

There is a favorable benefit-cost ratio in taking early measures when a disaster is imminent. Preparatory actions taken when spring floods have been forecast have resulted in substantial savings in postdisaster costs. For example, Operation Foresight in 1969 had an estimated 10-to-1 benefit-cost ratio.

Experience in fighting forest and grass fires shows that presuppression of fires has about a 4-to-1 benefit-cost ratio. In other words, with early detection and suppression, the firefighting costs and the fire losses are one-fourth of what they are when small fires become big ones.

There is a need for continuous modernization of emergency equipment and techniques. A case in point is the air tanker fleet for aerial firefighting.

Application of Science and Technology

Research on the causes and characteristics of natural disasters and for the protection of people and property holds great promise and is a national imperative.

The most immediate need is to apply the scientific and technological knowledge already existing. The sheer number and variety of disaster-related research activities in the government and private sectors now make it difficult to coordinate and integrate these activities. Further development of the following actions taken during the past year will contribute to better coordination of research activities and wider application of research results:

- The OEP disaster research clearinghouse will enhance the exchange of information between the scientific community and public officials.
- An assessment of existing disaster-related research activities by the National Academy of Sciences should provide a basis for greater application of research results and also help to focus future research efforts.
- The National Science Foundation, through the "Research Applied to National Needs" program and others, will promote interdisciplinary disaster research and enhance practical applications to disaster preparedness.

It is recognized that an interdisciplinary approach to disaster research is needed. Most disaster-related research in government and private research centers remains compartmented within the various traditional disciplines

and organizations. Consideration should be given to the desirability and practicability of establishing a National Center for Disaster Research to serve as a focal point for liaison with the many specialized research activities.

The connecting link between new knowledge—acquired through both experience and research—and improved disaster preparedness is evaluation. On-the-scene disaster evaluation is essential to timely and accurate recording of facts and lessons. With both predisaster and postdisaster critiques as parts of an evaluation program, the basis can be laid for testing and improving preparedness plans and procedures. Predisaster efforts aid in assuring preparedness levels, while postdisaster critiques assure the benefit of lessons learned from experience. Since Hurricane Camille, postdisaster critiques have been held more regularly and have served as important steps in arriving at significant improvements in legislation and in programs for preparedness and response.

Disaster Mitigation

Like protection, disaster mitigation begins with an estimate and appreciation of an area's vulnerability to natural disasters. The objective of mitigation is to find ways to reduce the vulnerability of people and property to damaging effects.

It is clear that something must be done about the way land is used, the kind of structures built on it, and the materials and practices used in construction. At present, these determinations are too fragmented among many private and government agencies. Furthermore, the government authority to regulate land-use and construction practices is in the hands of many local jurisdictions (State, county, and municipal) which are often influenced by competing socio-economic interests. Hence, there is a need for a national program involving Federal, State, and local jurisdictions in avoiding the mistakes of the past and in gaining fuller consideration of natural hazards in regulating land use and construction. Such a national program should include (1) nationally recognized disaster mitigation criteria, (2) data on the vulnerabilities of localities in disaster-prone areas, (3) a national focal point for land-use planning and building standards, and (4) conditions on the use of Federal loans, grants, and lending guarantee powers so that local jurisdictions enact and enforce disaster mitigation regulations.

The financial losses of individuals to natural disasters can be alleviated through insurance. Disaster insurance, however, is often not available, because actuarially sound rates cannot be determined on the basis of current knowledge of the risks involved. However, even when insurance is available, individuals now tend to rely on disaster benefits from the Federal assistance program, if this is to their advantage, rather than on insurance. Consequently, any Federal Government initiative to encourage wider disaster insurance coverage should also insist that rates be based on risks or that communities

act toward hazard reduction. A comprehensive disaster insurance program has many complex economic and public policy implications which need further careful study.

In surveying the causes of the natural disasters included in this study, it was determined that in some instances the means do now exist to prevent or alter climatic phenomena. Experiments in modifying the weather to reduce the wind intensity and perhaps change the direction of a hurricane, to alleviate drought, and to reduce the lightning from cumulus clouds (and thus

reduce a major cause of forest fires) should be pursued with high priority. However, the "down range" effects of weather modification are not fully predictable, and in many cases even the immediate effects are uncertain. Weather modification is a new and promising enterprise, offering untold possibilities but also unforeseen consequences. The possibilities and the consequences give rise to the need for management; because of interstate and international ramifications, consideration should be given to an expanded Federal role.

rsued
ffects
and in
ertain.
prise,
a con-
s give
rstate
uld be

PART III.

DISASTER PROTECTION

Federal, State, and local government programs concerned with preparedness for and emergency response to disasters are discussed under this general heading of Disaster Protection. These programs involve general and specific measures to cope with the existing vulnerability of people and property to disaster occurring in the United States. In Part IV, Disaster Mitigation, consideration is given to measures to reduce such vulnerability. This rather arbitrary distinction between protection and mitigation is made to emphasize better the elements of a comprehensive approach to disaster preparedness.

In studying the natural disasters which occur in the United States and the existing vulnerability to these

events, it is clear that certain preparedness measures will afford protection in greater or lesser degree in different types of disasters. At the same time, it is also clear that the differences among the types of disasters dictate identification of the special measures required for protection against each. General and special measures alike are needed for optimum protection.

Of the 11 chapters in this part of the report, one is devoted to General Measures and the others discuss 10 specific types of natural disasters in terms of prevention or control, prediction and warning, preparedness plans, and emergency response by government and the public.



Chapter A. General Measures

Disaster protection begins with recognition and understanding of the kinds of natural disasters likely in a given area and the vulnerability of the area to those disasters. Based on this understanding, all levels of government can establish objectives for achieving protection against the threats. Under the Federal system of government it is essential that the disaster preparedness programs be a cooperative and concerted effort involving Federal, State, and local government. Programs resulting from such cooperative effort require the application of science and technology, development of plans and organizations, allocation of resources, and education of the public.

Vulnerability Analysis

There has been insufficient attention to systematic analysis of the vulnerability of communities or larger jurisdictions to natural disasters. As a consequence, State and local governments are often not as well prepared to cope with natural disasters as they could be. For example, some States' natural disaster plans are patterned after civil defense plans for recovery from nuclear attack—plans that assume outside help would not be available (because the whole country would be stricken) and evacuation would not be feasible (because of the lack of mobility due to nuclear damage and radioactive fallout). In natural disaster planning, the opposite assumptions apply: outside help could be made available immediately; there would be time to evacuate, if necessary, and a place to go to; and movement would not be impeded (as by nuclear damage and radioactivity).

Federal programs now underway can assist State and local governments in determining their disaster vulnerability. For example, the Corps of Engineers will prepare an analysis of a community's vulnerability to floods and suggest measures which can be taken locally; the decision to take measures based on the analysis rests with the local government.

The National Oceanic and Atmospheric Administration (NOAA) is conducting vulnerability surveys of coastal communities with high risk of hurricanes and providing advice for local disaster planning; again, action pursuant to this advice must be initiated by the local government. Also, NOAA, under contract with the Office of Emergency Preparedness (OEP), is making an earthquake vulnerability analysis of the San Francisco

Bay area. This analysis is a prototype study that might be applied to all locations with earthquake potential as well as form the basis for coordinated earthquake preparedness planning by Federal, State, and local governments.

While vulnerability studies are discussed more fully in succeeding chapters, it is important to realize that vulnerability analysis is essential for development of plans for disaster protection and preparedness.

Disaster Planning

Since October 1969, the Federal Government has provided matching funds for the development of State disaster plans. Fewer than one-third of the States were participating by the end of 1971. There are many reasons for this lack of participation: some States consider their plans to be adequate, some States must wait for legislative action, and some States have limited funds available for this purpose. In 1971, OEP contracted with the Council of State Governments to prepare an "Example State Disaster Act" (now part of the Council's 1972 *Suggested State Legislation* and also included in Part VII of this report) and "Guidance for State Disaster Planning." The latter includes selections from various existing State plans to illustrate exemplary features, with special emphasis on those that reflect lessons learned from experience.

Concurrent with initiation of the earthquake vulnerability analysis, mentioned above, OEP has issued an "Outline Plan for Federal Response to a Major Earthquake." This planning document establishes planning assumptions and assigns planning responsibilities to Federal agencies. Upon completion of the earthquake vulnerability analysis, OEP will take steps to promote coordinated preparedness planning by Federal, State, and local agencies. This is viewed as the pilot project in integrated national planning for disasters.

Local plans and procedures to cope with disasters, large and small, are the keystone to the protection of life and property. However, few local governments can by themselves effectively prepare for, and cope with, major disasters; they need State and Federal assistance in preparation and recovery. Accordingly, local disaster plans should begin with an assessment of local capabilities for dealing with day-to-day emergencies; this constitutes a baseline. Then, local plans should identify

the major areas in which they will need local augmentation and outside assistance. Further, such planning should establish methods of coordination and control so that outside assistance can be efficiently applied.

Especially pertinent to an assessment of local government's role in disaster preparedness are the ideas expressed by Mayor Edwin W. Wade of Long Beach, California, in a recent speech describing that city's program. Excerpts from those remarks are included under Notes at the end of this chapter.

In the final analysis, all levels of government share responsibility for the development of mutually supporting disaster plans. OEP regards this premise as a basic principle for an integrated national disaster preparedness program. In this connection, OEP is establishing a coordinated Federal program, involving NOAA, the Corps of Engineers, the Office of Civil Defense (OCD), and other agencies, to provide specialized assistance in the development of local disaster preparedness plans.

In addition to the overall integrated national disaster plans, the following specialized supporting national plans have been or are being prepared:

- *Plan for Communications Support in Natural Disasters.* Joint efforts by OEP, the Office of Telecommunications Policy (OTP), and the Executive Agent for the National Communications System culminated in 1971 in the development of a national plan for communications support of Federal emergency response to major disasters. The plan prescribes the procedures for establishing communications to be used in coordinating Federal assistance to State and local governments when a major disaster threatens or occurs.
- *National Search and Rescue Plan.* The Departments of Defense, Commerce, and Transportation, the Federal Communications Commission, and the National Aeronautics and Space Administration coordinate their resources and responsibilities for emergency search and rescue (SAR) operations under a national SAR plan. The Air Force, Navy, and Coast Guard are the principal operating agencies. The SAR plan was last revised in 1969 and provides for coordinated sea and air operations in natural disasters and other emergencies.
- *Multi-Hospital Disaster Plan.* The San Fernando earthquake proved the lifesaving value of a coordinated area medical plan that had previously been established on a voluntarily basis by a number of hospitals in Los Angeles County. The experience of these hospitals has been reported in a film, "Date With Disaster," which depicts the development and execution of their plan. OEP has made this film available to communities and hospitals across the country as an example of what can be done through cooperative action.

Disaster Warning

Timely and accurate warning is a major factor in the protection of life and property in natural disasters. As

the following chapters show, the nature of the disaster and the timeliness of warning are basic considerations in the development of an effective disaster preparedness program.

Warning involves technological problems: (1) monitoring and detecting the precursor signs and signals of a developing disaster threat, (2) calculating and forecasting the time and place of the event, and (3) transmitting the warning to officials and the public. Timeliness and accuracy vary widely with different types of disasters—from virtually no practical warning capability in the case of earthquakes to rather significant capabilities in the case of hurricanes. Whatever the state of the art, timely and accurate warning and appropriate public response are central objectives.

OTP has conducted an intensive study to determine what technological improvements could be applied to natural disaster warning as well as enemy attack. The study recognized the desirability of implementing a national system to give a continuous capability for direct warning of the public. To this end, a program of studies and tests will be conducted to provide such a system and to assure that the cost of home receivers is brought within reach of the general public.

Emergency Resources

Natural disasters may often overwhelm local resources but are unlikely to overtax the Nation's resources. Because of the ready availability of outside assistance in natural disasters, it is more important to plan for receiving and distributing supplies from outside than to stockpile emergency supplies within a potential disaster area. An important exception is medical supplies; their immediate availability can be crucial. Packaged Disaster Hospitals, Natural Disaster Hospitals, and Hospital Reserve Inventories have been positioned throughout the country to supplement normal medical resources. Also, OEP and the Department of Housing and Urban Development are investigating the feasibility of stockpiling emergency and temporary housing resources.

Emergency Organization

The key to effective organization for response to natural disasters or any other emergency is simply to accelerate and reinforce existing, practiced governmental functions. An emergency is not the time to introduce a new and unfamiliar apparatus for coordination and control. The public looks to established political authorities to act quickly and effectively in an emergency.

OEP, on the basis of its experience in Hurricane Camille, has developed a concept for a field organization in which normal staffs are augmented by representatives of the principal Federal agencies involved in disaster operations and recovery assistance. This procedure has been practiced in subsequent disasters and was further

tested in carrying out Phase I of the Economic Stabilization Program in 1971. The concept is similarly applicable to State and local governments in meeting the emergencies of natural disasters.

Public Information

An informed public is essential to successful disaster protection and preparedness. The public must know when and how to prepare for an imminent disaster and what to do if it occurs. Unfortunately, there are practical difficulties raised by information and warning programs. For example, it is expensive in time and money to maintain a public alert for a disaster that does not happen, and such false alerts degrade public confidence in warnings. Or, as in the case of tsunamis, the alert may cause a curious public to endanger itself in its desire to see "the big wave." Elements of an effective public information program can sometimes be quite simple, for example, pages in the Oahu, Hawaii, telephone book giving ready reference for the tsunami danger area and evacuation routes. Infrequent disasters require theoretical explanations and case histories beyond the public's experience.

On the other hand, there are natural dangers—such as tornadoes and hurricanes—which occur more frequently in a given area and whose approach can usually be witnessed, thereby reinforcing the urgency of the warning. For these hazards, public knowledge and alertness can be reinforced as the season approaches. Thus, public information programs, to be effective, must be conceived for each individual type of disaster and for the particular threat to the community.

Disaster Legislation

Federal legislation has generally kept pace with the growing problems of disaster. (See Disaster Legislation, Part VI, Chapter A). This has not been the case with most State and local governments. State disaster laws have been changed in relatively few instances over the past two decades.

Most legislative effort has been directed to emergency measures in reaction to particular disasters; only recently has significant attention been given to State and local legislation intended to avoid or prepare for disasters. While continued attention must be given to strengthening State and local capabilities to react swiftly and effectively to disaster events, the primary thrust of legislative effort in the next few years should be aimed at enactment of land-use controls for areas particularly susceptible to disasters and enactment of building standards for structures subject to specific disaster threats. (See Land Use and Construction, Part IV, Chapter A.)

In general terms, effective response to disaster requires emergency allocation of resources and funds and

the establishment of priorities for their use. This, in turn, may require governmental officials, particularly at the local level, to exercise unusual control over, or assume the responsibility for, services normally provided by nongovernmental entities. Authority for these emergency actions, with such limitations and constraints as individual conditions dictate, should be included in State and local disaster acts and ordinances.

The Council of State Governments is devoting substantial attention to State legislation. The Example State Disaster Act is included in the Council's 1972 *Suggested State Legislation* and will be the basis of a concentrated effort by the Council to update State disaster legislation. The Example Act emphasizes the need for State preparedness actions and leadership, as well as for continuing and strengthening the authority of the Governor to respond to disaster emergencies. As part of its effort, the Council will assist States in analyzing their legislation and in drafting legislation to amend or augment existing State laws.

Findings

1. *Disaster vulnerability analysis is a prerequisite to formulating effective State and local disaster preparedness plans and programs.* The U.S. Army Corps of Engineers is doing such analysis with regard to floods, as are the Forest Service and Bureau of Land Management for forest fires and the National Oceanic and Atmospheric Administration for hurricanes. The OEP-NOAA earthquake study is designed to provide a prototype vulnerability analysis regarding earthquakes. These activities should be continued and should include other types of disasters that pose a high threat to life and property.

2. *Disaster preparedness plans and programs of many States and localities need to be improved.* To help accomplish this, PL 91-606 authorized matching funds for the development and maintenance of State disaster plans. The recent steps by OEP and the Council of State Governments to provide guidance and encouragement to the States to upgrade State and local disaster plans, with greater emphasis on preparedness, should lead to community and nationwide improvements.

3. *Public information is a vital element of disaster preparedness.* The most effective programs provide for quick and easy reference to essential information by the public when a disaster is imminent or occurs. Pages in the telephone book and emergency radio and TV broadcasts have been used effectively for this purpose in some areas and some types of disasters. These examples illustrate standard practices that should be developed in all regions for the sudden and life-threatening types of disasters they can expect.

4. *The "Example State Disaster Act" formulated and suggested by the Council of State Governments for action in 1972 provides an excellent model for updating State disaster legislation and enhancing disaster pre-*

paredness by all levels of government. The Council's subsequent program to assist individual States in drafting applicable legislative provisions should further enhance attainment of this objective.

Notes

The following excerpts are from an address on Anti-Disaster Measures in Cities by the Honorable Edwin W. Wade, Mayor of Long Beach, California, at the Second Plenary Session of the Japanese-American Conference of Mayors and Chamber of Commerce Representatives at Kyoto, Japan, October 23, 1971. (The entire text is available from OEP upon request.)

* * * * *

The City of Long Beach, which I represent, has made a concentrated effort during the past decade to develop an emergency preparedness program. I am satisfied that what we have accomplished will be of great benefit in a serious emergency, but the more I researched this subject in preparation for making this presentation today, the more I have become aware that much of the capacity inherent within our cities to deal with disasters lies dormant. I realize that even in the City of Long Beach much remains to be done before we can say that we have developed maximum readiness to help ourselves in time of disaster.

This matter of self-help is crucial to the development of a sound nationwide emergency preparedness program, because if a city is not willing to develop a capability of sustaining itself in a disaster situation then it must prematurely call for help from the outside. This process of determining when, how, and from whom to request help uses up time, and time is a precious commodity when citizens are in peril. Many lives can be lost in the confusion and disorganization that accompanies the lack of a full planning effort.

A city that fails to make a reasonable effort to develop its own capacity for survival thus allows itself to become a burden upon the higher echelons of government which must come to the rescue, and too often the rescue becomes a salvage type operation.

As I see it, every community has a choice to make, which, simply stated, is whether in time of emergency it chooses to be an asset to itself and its nation or whether it is willing to be a liability. I seriously doubt if there are many, if any, cities in either of our two great countries that can honestly say that they have fully developed their potential for the protection of life and property. I'm talking about the full utilization of resources that stand available within our communities but which lie dormant simply awaiting the type of organization and planning that will take full advantage of the existing potential.

Sustaining a high degree of readiness, of course, is not easy. There are expenses involved, but in Long Beach we have found that the cost need not be burdensome. Our full time emergency preparedness staff is quite small. We take advantage of the incentives offered by the Federal Government to communities willing to achieve the eligibility standards imposed as a condition for receiving such assistance. The staff in Long Beach is a coordinating group working in a staff capacity for the City Manager with the mission of developing a maximum coordinated disaster readiness effort within the total structure of city government with such augmentation as needed from the private sector.

Recognizing that there are limits to what a city can do to help itself, Long Beach is a part of a master mutual aid plan which pledges its help to sister communities when, because of the size of the catastrophe, they have a need for outside help.

They, in turn, are pledged to help us if and when we, too, require such assistance.

Maintaining a high degree of disaster readiness, however, is largely a question of attitude, and the building of a proper attitude throughout the city governmental structure begins at the top where policy is established. It isn't enough for the legislative body of the community, in our case the City Council, to only pass an ordinance establishing an emergency preparedness program. The City Council must show an interest in the ongoing activities as well. It should require a good disaster plan to be submitted for its approval. It should insist that the plan is not only kept up to date, but fully utilizes the available resources as well. The Council should also make it possible for city personnel to receive a reasonable amount of training in carrying out their disaster assignments and insist that such training be realistic and of a team-building character. Disaster exercises should be held periodically. . . .

* * * * *

In my judgment, it is essential to have a central place such as a well-protected emergency operating center where timely decisions based on accurate information can be well coordinated and then disseminated. It is here at the Emergency Operating Center where actions are taken to ascertain what resources are available, where key officials with these various resources at their immediate command can put their heads together and make the extraordinary judgments required to overcome the extraordinary problems which make a disaster a disaster.

I do not think I can put too much stress on the need for good communications because without it you cannot even get started. In Long Beach, we tie our key hospitals into our radio system. We also work closely with our extensive group of amateur radio operators and with certain critical industries. But no communications system is complete unless it also provides a means to broadcast important information and instructions to the public. . . .

* * * * *

We accept the fact that good training offers the greatest return for the time and energy invested; and for that reason, merits the greatest staff effort.

You might be interested in our plans for providing shelter for people rendered homeless due to disaster. Of course, we count heavily on the Red Cross to furnish the leadership and much of the staffing, but we do not feel that it is proper to just dump the whole load in their laps. Our planning is worked out jointly as a team effort. We augment the Red Cross staff by making available the city's entire roster of recreational employees and librarians. This makes a total staff of over 1,000 trained personnel immediately available to man sufficient pre-designated elementary schools and recreational centers to house 10,000 disaster victims. All of the assigned facilities have cafeterias, toilets, and sleeping space to house the homeless in reasonable comfort. If necessary, the city's entire system of school facilities can be made available and with additional staffing provided by the various school faculties, it would be possible to house at least 100,000 more people. . . .

* * * * *

The need to shelter a large mass of people, of course, would mean that a sizable area of the city has been devastated. Under these conditions, our city ordinance provides for either the City Manager, in his capacity as Director of Emergency Services, or the City Council to proclaim the existence of a disaster. Such a declaration automatically bestows upon the Director of Emergency Services extraordinary power sufficient to enable him to deal with the situation. In this status, he can legally issue proclamations establishing curfews, and/or setting forth rules and regulations as necessary to meet the city's needs. As Director, he activates and takes charge of the Emergency Operating Center, and the entire disaster organization is at his disposal. If necessary, he can close down private or public businesses or activities. He can also requisition and obligate the city for such supplies, equipment, and personal services as he deems necessary. All of this can be done without referral to the City Council. However, the Council is privileged to formally convene in order to ratify or negate an action or to delegate further authority if deemed appropriate. By proclaiming a disaster, it also becomes possible to immediately impose any additional building, traffic, or safety regulations that the situation dictates. For example, damaged buildings, if unsafe for occupancy, could be condemned, and if necessary, even destroyed and removed.

Starting with the Great Alaskan earthquake of March 27, 1964 up through the devastating hurricane of last year known as

Camille, we have witnessed in the United States a series of legislative acts which have greatly expanded the Federal role in major disasters. The latest such legislation known as the Disaster Relief Act of 1970 considerably increases the scope of federal assistance especially to meet the needs of individual victims. This has been a considerable change from the policy that existed several years ago when the losses suffered by an individual were largely his own to endure. Although the Red Cross has always made every effort to meet the immediate needs of individuals, for the first time government has concerned itself with personal problems to include the long term recovery of disaster victims. Home loans, business loans, debris clearance, rental and food allowances, and other services are now available to the private citizen. This has brought a new dimension to disaster preparedness planning. . . .

* * * * *

Whereas the Federal Government now provides a considerable amount of assistance, it remains for the city to withstand the first massive onslaught of the disaster. The city stands alone during those first frightful hours or perhaps days, and it is during this initial period of time when the good building codes, the good communications, the good decision making, and the good planning pays off in terms of lives and property saved. What is done or what is not done during this early period more than anything else will determine how well the public trust has been preserved.

