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Disaster Study Number 14



# FIELD STUDIES OF DISASTER BEHAVIOR

An Inventory

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Disaster Research Group

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National Research Council

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ANTHROPOLOGY AND PSYCHOLOGY**

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**DISASTER RESEARCH GROUP**

The Disaster Research Group is an activity of the Division of Anthropology and Psychology, National Academy of Sciences — National Research Council. It succeeds and carries on many of the functions of the Committee on Disaster Studies, which met under the auspices of the Division of Anthropology and Psychology from 1952 to 1957.

The Disaster Research Group conducts research, sponsors conferences and publications, and advises with officials on problems of human behavior in disaster and civil defense. It continues publication of the Disaster Study Series initiated by the Committee on Disaster Studies.

At present its activities are supported by a grant from the National Institute of Mental Health of the Department of Health, Education, and Welfare, a contract with the Office of Civil and Defense Mobilization, and a grant from the Ford Foundation.

**FIELD STUDIES  
OF DISASTER BEHAVIOR**

**An Inventory**

Disaster Study Number 14  
Disaster Research Group  
Division of Anthropology and Psychology

**FIELD STUDIES  
OF DISASTER BEHAVIOR**

**An Inventory**

by  
Disaster Research Group

Publication 886  
National Academy of Sciences—National Research Council  
Washington, D. C.  
1961

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## PREFACE

Subsequent to the initiation of a program of disaster research within the National Academy of Sciences—National Research Council in 1952, many efforts have been made to assist others in getting acquainted with and furthering the development of this field. Under the guidance of Dr. Harry B. Williams, the Academy-Research Council's first staff director for the program, the Disaster Study Series was initiated and developed at a relatively rapid rate. Seminars, sections of professional meetings, and special issues of journals have further contributed to progress in this area. Equally important have been the related efforts of fellow scientists outside the Academy-Research Council.

For a number of years, scholars and administrators have conceded their inability to keep abreast of all the research work within their general areas of interest. Their burden increases with each addition to the research community. Until electronic data processing and storage devices rescue scholars from the limitations of the traditional research tools, abstracts, annotated bibliographies, and inventories will provide some welcome shortcuts to their unending tasks. The annotated bibliography prepared by Miss Jeannette F. Rayner, which was published in Human Organization in 1957, represented one of the first efforts to facilitate the identification of some of the older as well as the more recent work on human behavior in disaster. In 1959, Mr. Charles E. Fritz, with the assistance of Mr. Mark J. Nearman and Mrs. Devorah K. Rubin, appreciably aided the busy scholar with their work, An Inventory of Field Studies on Human Behavior in Disasters, which was published by the National Academy of Sciences—National Research Council.

A few months after publication of the Inventory, it was decided that the document should be brought up to date and revised as soon as the supply of the first edition warranted. In revising, the most obvious need was a change in format. As planning for a new edition progressed, other modifications were indicated. In Mr. Fritz's Explanatory Notes and in his classification scheme, he distinguished between disasters and accidents. Inasmuch as numerous major

disasters have been the results of accidents, such a distinction seems at best tenuous and generally of little consequence for the study of human behavior. (If the blaze that ignited Coconut Grove had been the work of an arsonist the behavior of the occupants would have been the same.)

The body of the first Inventory included studies of at least two events which were not disastrous—a flood warning that occurred in Pennsylvania in 1955 and a smog black-out that affected London in the same year. However, studies of two false warnings for air attacks, one in 1955 and another in 1958, were explicitly excluded. In the interest of consistency as well as for more important conceptual reasons—suggested in the Guide to the revised Inventory—all studies of false warnings are now included in the body of the Inventory.

One omission in the revised Inventory should be acknowledged. The revision does not include 63 miscellaneous studies conducted at NORC largely for training and pre-test purposes. There were no research reports published for any of these activities.

That the reader and the Disaster Research Group are greatly indebted to Mr. Fritz and his two assistants for the preparation of the first Inventory is gratefully acknowledged. In preparing the revision, Mr. Fritz served as a consultant for a brief period. Mr. Mark J. Nearman's help in preparing the revision is equally appreciated. He collected, organized, and integrated new material for the second edition, and prepared the indexes. He also assisted the Technical Director in drafting the Guide to the Inventory. The Guide, with the conceptual and classificatory exceptions already noted, includes a generous portion of the content of Mr. Fritz's Explanatory Notes.

Adopting the vein which Professor Dwight W. Chapman expressed when he wrote the Introduction for a 1954 special issue of the Journal of Social Issues, I will be gratified if this Inventory soon meets "the happy fate of rapid obsolescence." If we are to be more adequately prepared to predict and control human behavior in natural disasters, as well as in man-made ones of a scale not yet experienced, the storehouse of our information must be augmented with many rigorous studies. The need should be met by imaginative field studies, as well as experimental ones, with fresh conceptual approaches. Each study should be guided by appropriate theoretical considerations, thus keeping these works in the main streams of behavioral science. The recent essay on disasters by Professor

Charles P. Loomis, in his work, Social Systems, represents a most comprehensive attempt to provide some of these essential dimensions for future studies of disaster behavior.

The preparation and publication of this report were made possible by funds provided under the Disaster Research Group's contract with the Office of Civil and Defense Mobilization, CD-SR-58-70. The contract is monitored by the Social Science Division of OCDM.

George W. Baker  
Technical Director  
Disaster Research Group

28 July 1961

## GUIDE TO THE INVENTORY

This document provides a relatively complete list of the field studies on human behavior in disaster that have been conducted by behavioral scientists. A number of fugitive research papers, probably best known to the staff of the Disaster Research Group, are included. The Inventory is intended to assist research personnel, administrators, and others interested in disaster research findings in the identification and location of pertinent reports and other research products.

### Coverage

Emphasis in the Inventory is primarily on studies of peacetime disasters affecting civilian groups and populations. As the summary table on page 64 shows, 114 field studies of human behavior in 103 different disaster situations have been catalogued. Only six of the studies are concerned with World War II bombings. The 114 studies have produced over 21,000 interviews and questionnaires, more than 14,000 with individuals exposed to peacetime disasters and more than 7,000 with German and Japanese residents affected by World War II bombings. Most of the studies have been conducted within the past ten years. However, two early studies of both historical and scientific interest are included: Samuel Prince's study of the 1917 Halifax explosion, and William James' observations on the 1906 San Francisco earthquake.

All of the events listed in the body of the Inventory did not result in disaster. This is characteristic of the false air alerts and other warning studies. Two important considerations dictated that they be included: (1) The student of human behavior in disaster who studies an event that resulted in deaths, injuries, and dislocations within a population is plagued by sampling limitations that follow from these characteristics. On the other hand, populations exposed to false air alerts or other false warnings are not fragmented, nor are they permanently dislocated. Therefore, for some research purposes, such a class of events often provides a more satisfactory base from which to generalize than do real disasters. (2) The student who is especially interested in the threat or warning phase of disaster behavior may be able to learn just as much from a false alert as he could from a disastrous event, if the stimulus or warning was perceived as being real.

To date the use of field studies in the exploration and analysis of human behavior in disaster heavily outweighs the use of experimental and laboratory techniques. The few experimental studies that have been reported are presented in Appendix A.

The eleven field studies of civil defense tests reported in Appendix B are included primarily because they provide organizational, group, and individual performance data for various segments of the United States population. Such information may have some predictive value for future disasters. These eleven studies, conducted largely by personnel experienced in disaster research, resulted in the accumulation of 2,578 interviews and questionnaires.

#### Sources

The primary source of information for the compilation of the Inventory was the published and unpublished reports, manuscripts, and bibliographic material on file in the office of the Disaster Research Group. The Group and its predecessor, the Committee on Disaster Studies, have been actively involved in the sponsorship, coordination, and conduct of disaster research since 1952, and have collected a bibliography of over 15,000 items on disaster and a library of over 1,200 documents. Therefore, their files are relatively complete. Where these files did not contain all necessary data, the information was sought directly from the research personnel concerned.

#### Definition of "Disaster Field Study"

For this report, a "disaster field study" is defined as a study in which the behavioral scientist goes to or near the site of an actual or potential disaster, selects some aspect or problem of human behavior in the event, and attempts to exercise at least minimal scientific control over the collection, analysis, and reporting processes. This admittedly loose and arbitrary definition permits inclusion of a considerable range of studies, from those which are exploratory in nature to those which are planned to test explicit hypotheses. This broad definition also permits inclusion of numerous small-scale studies that may be methodologically inadequate but often contain valuable notes, observations, and insights.

#### Disaster Distinctions

This report offers no formal definition of disaster. It may be useful, however, to identify some of its general characteristics. Such events usually involve property loss, danger, injury, physical

destruction, death, or other serious privations of normal life for the participants. In addition to these commonalities, it should be noted that disasters differ in many ways: in predictability, inevitability, and controllability, and in the origin, speed, scope, duration, destructiveness, and repetitiveness of the agent.

#### Limitations

The definition of "disaster field study" adopted herein automatically excludes many research studies and documents that are pertinent for a complete consideration of human behavior in disaster. Among those excluded are (a) ecological and demographic studies of bombings; (b) public opinion and attitude studies of civil defense; (c) summaries and reviews of disaster research findings; (d) many "eyewitness" accounts and social histories of disaster; (e) a large body of studies of military groups under conditions of combat, imprisonment, and environmental stress; (f) studies of civilian populations in concentration camps, prisons, and other conditions of purposefully-induced punishment and stress. Many of these categories of crisis and stress literature deserve inventories of their own.

#### Organization of the Inventory

The primary precipitating agent for a disaster provides the basis for classifying the disaster events catalogued in the Inventory. Twelve major descriptive categories and one residual one are employed. Studies of these events are sequentially numbered within each category and ordered by date of disaster, from earliest to latest. Within each category the following details are presented in tabular form for each of the studies: (a) event, (b) data, (c) location, (d) damage, (e) number of interviews, (f) research agency and principal research personnel, and (g) reports and references. Whenever information has not been available on damage or number of interviews for a given study of an event, an "n. g." for "not given" is entered.

1. Event. This column identifies the specific, primary precipitating agent. Where the event overlaps two major categories, a footnote cross-references this fact; e. g., the 1955 Tampico flood is entered under "Floods" and a cross reference is placed under "Hurricanes." However, any given disaster may involve a variety of secondary dangers or destructive agents; e. g., an explosion often produces earth shock and fire. No cross-referencing of these secondary agents has been made.

2. Date. Dates are those reported by the research personnel who studied the event.

3. Location. The location given does not necessarily circumscribe the actual boundaries of the area affected by the disaster, but rather identifies the geographic focus of the study.

4. Damage. This item provides the reader with a means for identifying the relative severity of a disaster. Emphasis is given to deaths, injuries, property destruction, and property damage. Special features of a given disaster are sometimes added, e.g., the number of evacuees.

5. Number of Interviews. When the findings or observations of a particular study are based on interview data, the number of interviews is recorded with no additional entry. If the findings are based on questionnaires or observational techniques, this is specifically noted in the column. For studies that have employed a combination of techniques, the column contains a total number, and a footnote shows the contributions of each technique. If the interview sample is known to have been centered on a particular category of respondents, an entry is made to that effect, e.g., "firemen," "mothers." In a few cases where the exact number of interviews was not ascertainable, research personnel identified with the study supplied an approximate number; this is noted in the text by "(approx. )" after the number.

6. Research Agency and Principal Research Personnel. Research personnel, listed alphabetically, are identified by the research agency or the university with which they were associated at the time the study was conducted.

A study whose number is preceded by an asterisk (\*) received some financial support or sponsorship from the Disaster Research Group or its predecessor, the Committee on Disaster Studies.

7. Reports and References. The reports and references cited are those known or believed to provide the most complete presentation of the findings for a particular study. While some of the studies have produced methodological reports, as well as unpublished technical papers, these have been excluded unless they contain specific substantive findings not found in other reports. Reports that only summarize, survey, or review findings from other research reports have also been excluded.

In a few cases, reports were written by persons other than those gathering field data; therefore, these authors are not listed as research personnel.

When no reports are listed for a study, it should be assumed that a report has not been produced or the project is still in progress.

A. AIRPLANES

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
1. Airshow crash	15 Sep 1951	Flagler, Colo.	pilot & 20 spectators killed, about 30 injured	42
2. Three plane crashes in the same urban area	16 Dec 1951	Elizabeth, N. J.	all 56 passengers & crew killed, 1 resident injured; plane destroyed	110
	22 Jan 1952		all 23 passengers & crew killed, 7 residents killed & 3 injured; 2 apartment bldgs. & 1 house destroyed by fire, plane destroyed	
	11 Feb 1952		24 of 59 passengers & 3 of 4 crew members killed, 4 residents killed, 43 passengers & residents injured; 52-family apartment bldg. damaged, plane destroyed	
3. (Same as 2)				24

Research agency and  
principal research personnel

Nat. Opinion Res. Center,  
Chicago, Ill.

Charles E. Fritz  
Shirley A. Star

Nat. Opinion Res. Center,  
Chicago, Ill.

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John Walker Powell  
Jeannette F. Rayner

Reports and references

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B. BLIZZARDS

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
*1. Blizzards	Feb 1957	Sedalia, Colo.	n. g.	4
	Apr 1957	Truckston, Colo.	n. g.	4
*2. Blizzard	19-21 Mar 1958	Pa. Turnpike (Morgan- town, Pa.)	1 killed, about 800 stranded in restaurant for 36 hours	11

\*Supported by Disaster Research Group.

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principal research personnel

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Disaster Res. Group, NAS-  
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Charles E. Fritz  
Samuel L. Guskin  
Jeannette F. Rayner

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Disaster Studies, 1957.
  
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& Guskin, S. L. Behavior in an emer-  
gency shelter: a field study of 800 per-  
sons stranded in a highway restaurant.  
Washington: NAS-NRC, Disaster Res.  
Group, 1958.

C. EARTHQUAKES, VOLCANIC ERUPTIONS, AND OTHER LAND MOVEMENTS<sup>a</sup>

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
1. Earthquake and fire	18-19 April 1906	San Francisco, Calif.	452 killed; est. \$350 million damage	observation
2. Earthquake	15 Jan 1934	Bihar Prov., India	n. g.	n. g.
3. Landslides caused by 32-inch rainfall in 3 days	13 June 1950	Darjeeling & environs, India	150 killed in district, 30 in town itself, over 100 injured, 2,000 homeless; 200 houses damaged	n. g. <sup>b</sup>
4. Volcanic eruption	21 Jan 1951	Mt. Lamington, New Guinea	about 4,000 killed, 5,000 forced to evacuate village	46 <sup>c</sup> (approx.)
5. Earthquake	22 Aug 1952	Bakersfield, Calif.	2 killed, 32 injured; damage or destruction to bldgs. in 98 sq. blocks of central business district	57
6. Volcanic eruption	13 Jan-March 1960	Kapoho, Hawaii	over 250 evacuated, town almost completely destroyed; several million dollars damage	1411 <sup>d</sup>

<sup>a</sup>See also: 1. MINE DISASTERS: 3. Mine cave-in.

<sup>b</sup>"Darjeeling had about 3,000 visitors in June. Reports and rumors were collected mostly from them."

<sup>c</sup>Approximately 16 interviews with government officials and 30 with victims; observational techniques were also used.

<sup>d</sup>161 in experimental group; 1,250 in "control" group.

Research agency and  
principal research personnel

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Human reactions in disaster situations.  
Unpublished manuscript, Nat. Opinion  
Res. Center, 1954. Vol. 3, pp. 96-103.
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and beliefs during the recent volcanic  
eruption at Kapoho, Hawaii. Science,  
1960, 131, 1095-1096.

C. EARTHQUAKES, VOLCANIC ERUPTIONS, AND OTHER LAND  
MOVEMENTS (continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
7. Earthquake	21-22 May 1960	Southern Chile	about 2,000 killed, few injured; \$300 million damage	observation and informal interviews
8. Tidal wave (Tsunami)	23 May 1960	Hilo, Hawaii	61 killed or missing, over 300 injured; over 500 homes & businesses destroyed, millions of dollars in property damage	327

Research agency and  
principal research personnel

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Reports and references

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D. EPIDEMICS AND EPIDEMIC THREATS

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
1. Rabies outbreak	Mar 1952	Eastern Pa.	"several" children bitten, one woman killed by rabid wild foxes	300
2. Polio outbreak	15 May-19 Sep 1953	Montgomery, Ala.	109 polio cases & 7 deaths in Montgomery County, most cases in the city	225 (married women)
*3. Typhoid threat following a flood	Aug 1955	Winsted, Conn.	none	48
*4. Polio outbreak	Sep 1955	Chelsea, Needham, & Weymouth, Mass.	456 reported polio cases	328 (mothers of elementary school-age children)

\*Supported by Disaster Research Group.

Research agency and  
principal research personnel

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Harry B. Williams, CDS

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D. EPIDEMICS AND EPIDEMIC THREATS (continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
5. Asian influenza outbreak	1 Oct- 1 Dec 1957	Continental United States (5 survey cities)	45 million cases in U.S. during Oct. & Nov., 1957	1,586

Research agency and  
principal research personnel

Public Health Service, Dept. of  
Health, Education & Welfare,  
Washington, D.C.

R. H. Drachman  
G. M. Hochbaum  
I. M. Rosenstock

Reports and references

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& Rosenstock, I. M. Asian strain in-  
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& Leventhal, H. The impact of Asian  
influenza on community life: a study of  
five cities. Washington: U. S. Dept.  
of Health, Education, & Welfare, Publ.  
Hlth. Serv., 1960

E. EXPLOSIONS AND FIRES

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
1. Munitions ship explosion in harbor	6 Dec 1917	Halifax, Nova Scotia	2,000 killed, 6,000 injured, 10,000 homeless; 300 acres destroyed or damaged, \$35 million property damage	n. g.
2. Ship explosions in harbor	16-17 Apr 1947	Texas City, Texas	512 killed, almost 4,000 injured; \$76 million damage	56
3. Dormitory fire	3 Dec 1949	Men's dorm., Univ. of Oklahoma, Norman, Okla.	3 killed	20
4. Ammunition and dynamite explosion	19 May 1950	South Amboy, N. J.	31 killed, about 400 injured; extensive blast damage within 1 1/4-mile radius	300 (approx.)
5. Industrial plant explosion	8 Feb 1951	St. Paul, Minn.	14 killed, 50 injured; over \$1 million damage to industrial plant	10

Research agency and  
principal research personnel

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E. EXPLOSIONS AND FIRES (continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
6. Dormitory fire and explosion	28 Apr 1951	Women's residence hall, Northwest Mo. Coll., Maryville, Mo.	a few injured	30
7. Forest fire	20 Sep 1951	Forks, Wash.	over \$1 million damage	participant observation
8. House explosions and fires	21 Sep 1951	Brighton, N. Y.	2 killed, 24 injured; 16 houses destroyed, 25 damaged	36
*9. Fireworks plant explosion	5 Jun 1953	Houston, Texas	4 killed, 96 injured; 30 homes damaged beyond repair	139
*10. Ship explosion	26 May 1954	U. S. S. Bennington	9 killed, 215 injured (12 died later)	15
*11. Fireworks plant explosion	16 Jul 1954	Chester-town, Md.	11 killed, 5 seriously injured, 50 minor injuries; 35 bldgs. damaged	20

\*Supported by Disaster Research Group.

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NAS-NRC, (1958).

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E. EXPLOSIONS AND FIRES (continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
*12. School bus fire	1 Mar 1955	Silver Spring, Md.	no injuries	7
*13. Atomic laboratory explosion (thorium)	2 Jul 1956	Bayside, N. Y.	4 seriously injured (1 died later); \$125,000 damage to AEC equip. & bldg. of contractor; neighborhood aroused by "radiation hazard"	45

\*Supported by Disaster Research Group.

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F. FALSE ALERTS

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
*1. Smog blackout	16 Jan 1955	London, England	dense cloud of black smoke settled on city for about 10 min; no deaths or destruction	327
2. False air raid alert	5 May 1955	Oakland, Calif.	accidental sounding of alert signals	162 <sup>a</sup>
3. (Same as 2)				146
*4. False warning of dam burst	19 Aug 1955	Port Jervis, N. Y.	about 2,500 people fled at announcement of dam burst; no deaths or destruction	138 <sup>b</sup>
5. Threat of dam burst	16 Oct 1955	Schenectady, N. Y.	threat of dam breaking and flooding houses; little actual damage without dam breaking	30 (approx.)
*6. False air raid warning	25 Nov 1958	Washington, D.C.	accidental sounding of evacuation signal in Government offices	1909 <sup>c</sup>
*7. Surprise sounding of air raid sirens	22 Sep 1959	Chicago, Ill.	unannounced use of air raid sirens to celebrate sports event victory	241

\*Supported by Disaster Research Group.  
<sup>a</sup>77 interviews and 85 questionnaires, both with officials.  
<sup>b</sup>107 sample respondents, 31 special informants.  
<sup>c</sup>218 interviews, 1691 questionnaires.

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G. FLOODS<sup>a</sup>

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
1. Flood	Jan 1937	Louisville, Ky.	250 killed; over 200,000 evacuated	n. g.
2. (Same as 1)		Shawnee- town, Ill.	1,700 homeless for 6 weeks; \$2 million prop- erty damage	200
3. Flood and fire	12-17 Jul 1951	Kansas City, Mo.	3 killed, thousands home- less	83 (firemen)
4. Flood	Jul 1951	Miami, Okla.	n. g.	observation
*5. Flood	1 Feb 1953	English Coast on North Sea	307 killed, several hundred missing, all 12,000 residents evacuated	46 house- holds

\*Supported by Disaster Research Group.

<sup>a</sup>See also: C. EARTHQUAKES, ETC.: 8. Tidal Wave (Tsunami); D.

EPIDEMICS:

3. Typhoid threat following a flood.

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G. FLOODS (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
*6. Flood	1 Feb 1953	English Coast on North Sea	307 killed, several hundred missing, all 12,000 residents evacuated	150 (approx.)
*7. Flood	1 Feb 1953	Southwest Netherlands	1,783 killed, over 70,000 evacuated; over 500,000 acres flooded	n.g.
*8. (Same as 7)				114

\*Supported by Disaster Research Group.

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G. FLOODS (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
*9. Flood	1 Feb 1953	Southwest Netherlands	1,783 killed, over 70,000 evacuated; over 500,000 acres flooded	1,370 <sup>a</sup>
*10. Flood	27-30 Jun 1954	Eagle Pass, Texas; Piedras Negras, Mexico	Eagle Pass: 360 injured; 55 bldgs. destroyed, 325 damaged. Piedras Negras: 130 killed, 4,000 injured; 1,350 bldgs. destroyed, 2,850 damaged	250

\*Supported by Disaster Research Group.  
<sup>a</sup>880 interviews and 490 questionnaires.

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G. FLOODS (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
*11. Flood	18 Aug 1955	Farmington, Conn.	Conn.: 77 killed, 4,837 injured, 6,000 evacuated; 691 houses destroyed, 10,455 damaged. Farmington: over 300 families evacu- ated; 130 houses destroyed, 240 damaged	414
*12. Flood	30 Sep 1955	Tampico, Mexico	About 3,000 killed; 4,800 houses destroyed, 6,500 heavily damaged	16
*13. Flood	19-23 Dec 1955	Yuba City, Calif.	39 killed, 3,000 injured; 6,000 homes damaged	275
*14. Flood	Apr 1957	Dallas, Texas	residents in lowlands evacuated homes 3 times in 3 weeks	52
*15. Flood	Sep 1958	Abram, Texas; Reynosa, Mexico	n. g.	142*
16. Flash Floods	Nov 1960	Austin, Kennedy, & Rio Grande City, Texas	4 killed, 34 injured; \$97,900 property damage	227

\*Supported by Disaster Research Group.  
\*77 in Abram, 65 in Reynosa.

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## H. HURRICANES AND TYPHOONS<sup>a</sup>

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
1. Typhoons	2 & 10 Nov, 23 Dec 1947; 13 Jan 1948	Yap, West- ern Caro- line Islands	none killed; few in- jured; considerable damage to houses & canoes	observation
2. Typhoons	26 Jan 1952, 2 Feb 1953	Tikopia, British Solomon Islands	various areas flooded, 50% of crops damaged with entire coconut & breadfruit crops de- stroyed	participant observation (diary)
*3. Hurricane Barbara	14 Aug 1953	Ocean City, Md.	none	15
*4. Hurricane Florence	25 Sep 1953	Panama City, Fla.	none	90
5. Hurricanes Carol & Edna	31 Aug, 11 Sep 1954	Portsmouth, n. g. N. H.		n. g. b
*6. Hurricane Audrey	27 Jun 1957	Cameron Parish, La.	about 400 killed, about 2,500 evacuated; 500 houses destroyed, 300 badly damaged; 30,000 cattle & 1,800 horses killed.	154

\*Supported by Disaster Research Group.

<sup>a</sup>See also: G. FLOODS: 11. & 12.

<sup>b</sup>"An area sample of the city was made and subjects were interviewed and re-  
quested to answer questions contained on a prepared schedule."

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H. HURRICANES AND TYPHOONS (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
*7. Hurricane Audrey	27 Jun 1957	Cameron Parish, La.	about 400 killed, about 2,500 evacuated; 500 houses destroyed, 300 badly damaged; 30,000 cattle & 1,800 horses killed.	75
*8. (Same as 7)				
*9. Typhoon	30 Nov 1960	Ulithi, Caroline Islands	2 killed, 4 injured; 1/4 of houses wrecked, 1/2 severely damaged, 2/3 of sailing canoes wrecked	30 (approx.)

\*Supported by Disaster Research Group.

\*Longitudinal study initiated in Spring of 1961. Completion anticipated in Fall of 1961.

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I. MINE DISASTERS

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
1. Mine explosion	21 Dec 1951	West Frankfort, Ill.	of 218-man shift, 120 killed & 4 injured	28
2. (Same as 1)				7
*3. Mine cave-in	23 Oct 1958	"Minetown," Nova Scotia	75 miners killed, 19 trapped from 6 1/2 to 8 1/2 days	262*

\*Supported by Disaster Research Group.  
\*230 interviews and 32 questionnaires.

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J. TORNADOES

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
1. Tornado	12 Apr 1945	Antlers, Okla.	68 killed, 169 injured	27
2. Tornado	9 Apr 1947	Woodward, Okla.	95 killed, nearly 500 injured	48
3. Tornado	28 Apr 1950	Holdenville, Okla.	5 killed, 28 injured; 215 houses damaged or destroyed	34
4. Tornado	15 Sep 1950	Sasakwa, Okla.	5 injured	10
5. Tornadoes	5 Apr 1951	3 rural schools in Okla.	3 injured	66
6. Tornado	8 Jun 1951	Colony & Corn, Okla.	Colony: none killed; 15 houses & 2 schools destroyed. Corn: none killed or injured; 20- 25 houses, a church, & old peoples' home destroyed	10
7. Tornadoes	19 Jun 1951	Minneapolis, Minn.	1 killed, a few injured	4

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J. TORNADOES (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
8. Tornado	21 Mar 1952	9 counties & 18 communities in Arkansas	120 killed, over 700 injured; about \$7 million property and crop damage (throughout state)	423 <sup>a</sup>
		White Co., Ark.	46 killed, 615 injured; 558 bldgs. destroyed, over 800 damaged; est. damage \$3.5 million	
*9. (Same as 8)				reanalysis of data from pre- ceding study)
10. (Same as 8)		England, Ark.	n. g.	29
		Judsonia, Ark.	35 killed, nearly 400 injured; over 75% of houses destroyed or made unlivable	41
*11. Tornado	30 Apr 1953	Warner Robins, Ga.	19 killed, 450 injured; 365 homes destroyed, \$12 million damage to Government property	30 (approx.)
*12. Tornado	11 Apr 1953	Waco, Texas	114 killed, 600 injured, over 1,000 homeless; 198 commerc. bldgs. destroyed, 445 damaged; 125 homes destroyed, 750 damaged; bldg. losses est. \$52 million	36

\*Supported by Disaster Research Group.  
<sup>a</sup>342 regular sample, 81 special informants.

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Reports and references

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J. TORNADOES (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
*13. Tornado	11 Apr 1953	Waco, Texas	114 killed, 600 injured, over 1,000 homeless; 198 commercial bldgs. destroyed, 445 damaged; 125 homes destroyed, 750 damaged; bldg. losses est. \$52 million	208
*14. (Same as 13)				
*15. Tornado	11 Apr 1953	*San Angelo, Texas	10 killed, 166 injured 1,200 homeless; 320 homes destroyed, 199 damaged; est. over \$3 million loss	141

\*Supported by Disaster Research Group.

\*See 26. Severe storm, below, for continuation of study.

<sup>b</sup>Study initiated in Spring of 1961. Completion anticipated in Fall of 1961.

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Reports and references

- 13.1 Crawford, F. R., & Moore, H. E. Waco-San Angelo disaster study--first annual report. Unpublished report, Univ. of Texas, 1954.
- 13.2 Moore, H. E., & Crawford, F. R. Waco-San Angelo disaster study: report on second year's work. Unpublished report, Univ. of Texas, 1955.
- 13.3 Crawford, F. R. Patterns of family readjustments to tornado disasters: a sociological case study. Unpublished doctoral dissertation, Univ. of Texas, 1957.
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- 15.1 Crawford, F. R., & Moore, H. E. Waco-San Angelo disaster study--first annual report. Unpublished report, Univ. of Texas, 1954.
- 15.2 Moore, H. E., & Crawford, F. R. Waco-San Angelo disaster study: report on second year's work. Unpublished report, Univ. of Texas (1955).
- 15.3 Crawford, F. R. Patterns of family readjustments to tornado disasters: a sociological case study. Unpublished doctoral dissertation, Univ. of Texas, 1957.
- 15.4 Moore, H. E. Tornadoes over Texas. Austin: Univ. of Texas Press, 1958.

J. TORNADOES (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
*16. Tornado	8 Jun 1953	Flint- Beecher, Mich.	116 killed, 811 injured, over 1,500 homeless; 390 bldgs. destroyed, 276 damaged	over 200
*17. (Same as 16)				80 <sup>a</sup>
*18. (Same as 16)				
*19. Tornado	9 Jun 1953	Worcester, Mass.	66 killed, 738 injured; 250 dwelling units de- stroyed; \$32 million damage	57
*20. (Same as 19)				90

<sup>a</sup>Supported by Disaster Research Group.

<sup>b</sup>Total of 80 interviews obtained by investigator for both Flint-Beecher and Worcester tornadoes.

<sup>c</sup>Study initiated in Spring of 1961. Completion anticipated in Fall of 1961.

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Reports and references

- 16.1 Form, W. H., Nosow, S., Stone, G. P., & Westie, C. M. Final report on the Flint-Beecher tornado. Unpublished report, Social Res. Service, Michigan State Coll., 1954.
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- 20.1 Bakst, H. J., Berg, R. L., Forster, F. D., & Raker, J. W. The Worcester County tornado--a medical study of the disaster. Washington: NAS-NRC, Committee on Disaster Studies, 1955. (LIMITED DISTRIBUTION)

J. TORNADOES (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
21. Tornado	9 Jun 1953	Worcester, Mass.	66 killed, 738 injured; 250 dwelling units de- stroyed; \$32 million damage	-- <sup>a</sup>
*22. (Same as 21)				50 (approx.)
*23. (Same as 21)				-- <sup>b</sup>
*24. (Same as 21)				
*25. Tornado	5 Dec 1953	Vicksburg, n. g. Miss.		91 (families)
*26. Severe storm	7 Jun 1954	San Angelo, Texas	none killed, 2 injured; \$2.4 million damage	109

\*Supported by Disaster Research Group.

<sup>a</sup>48 interviews used included in 57 used by Wallace.

<sup>b</sup>Total of 80 interviews obtained by investigator for both Flint-Beecher and Worcester tornadoes.

<sup>c</sup>Study initiated in Spring of 1961. Completion anticipated in Fall of 1961.

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Reports and references

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a study of the fire fighters in the  
Worcester-Shrewsbury tornado, June  
1953. Unpublished manuscript, Com-  
mittee on Disaster Studies, NAS-NRC,  
1955.

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Herzfeld, Regina F. An exploratory  
study of the role of the Catholic Church  
organizations in disaster. Washington:  
NAS-NRC, Committee on Disaster  
Studies, 1954.

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a natural disaster. Unpublished  
doctoral dissertation, Harvard Univ.,  
1955.

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D. A. The child and his family in  
disaster: a study of the 1953 Vicksburg  
tornado. Washington: NAS-NRC, 1956.

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F. R. Crawford. Waco-San Angelo  
disaster study: report on second year's  
work. Unpublished report, Univ. of  
Texas, 1955.

26.2 Crawford, F. R. Patterns of family  
readjustments to tornado disasters: a  
sociological case study. Unpublished  
doctoral dissertation, Univ. of Texas,  
1957.

J. TORNADOES (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
*27. Tornadces	1 Feb 1955	Tunica & De Soto Counties, Miss.	about 29 killed	14 (families)
*28. Tornado	25 May 1955	Udall, Kans.	79 killed, 270 injured	111
*29. Tornado	3 Apr 1956	Grand Rapids, Mich.	17 killed, 262 injured	20 (officials)
*30. Tornado	2 Apr 1957	Dallas, Texas	10 killed, 162 injured, 800 families affected; 155 bldgs. destroyed, 463 damaged	142

\*Supported by Disaster Research Group.

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Reports and references

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J. TORNADOES (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
*31. Tornado	20 May 1957	Kansas City, Mo.	none killed, 300 injured; 350 houses destroyed, 400 damaged	21

\*Supported by Disaster Research Group.

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Reports and references

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**K. TOXICOLOGICAL SUBSTANCES**

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
1. Methanol "moon-shine" poisoning	21-26 Oct 1951	Atlanta, Ga.	39 killed, 9 totally blinded	11
2. Chemical smoke	Aug 1952	Philadel- phia, Pa.	30 given first aid, 5 hospitalized	4
3. Carbon monoxide asphyxia- tion	8 Dec 1952	Chicago, Ill.	none killed, 43 affected by gas	17
4. Chlorine gas	20 Jan 1953	Portsmouth, N. H.	32 injured	13
5. Chlorine gas	28 Jul 1953	Edgewood, Md.	none	22
6. Food poisoning	Aug 1959	"Gabriel" (a small Midwestern town)	none killed, 1,100 injured; est. \$27,157 damage	50 (approx.)
7. Toxic gas	12 Aug 1960	"Bayview" (a small Southern town)	none killed, 64 injured	50 (approx.)

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Reports and references

- 1.1 Powell, J. W. A poison liquor episode in Atlanta, Georgia. In Conference on field studies of reactions to disaster. Chicago: Nat. Opinion Res. Center, 1953.
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- 5.1 (See preceding report)
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K. TOXICOLOGICAL SUBSTANCES (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
8. Chlorine gas	31 Jan 1961	Pointe Coupee Parish, La.	1 killed, about 100 injured; numerous animals killed	60

Research agency and  
principal research personnel

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Reports and references

- 8.1 Segaloff, L. Community reaction to an  
accidental chlorine exposure (Task  
Sirocco). Philadelphia: Univ. of  
Pennsylvania, Inst. for Cooperative  
Res., 1961.

L. WORLD WAR II BOMBINGS

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
1. Conventional (high explosive) bombing	1942-1945	Germany	305,000 killed, 780,000 injured, 4,885,000 evacuated, 14 million suffered moderate to severe personal property loss; 1,865,000 homes destroyed	3,711 <sup>a</sup>
2. Conventional (high explosive) bombing	15 Jun 1944-15 Aug 1945	Japan	900,000 killed, 1.3 million injured, 8.5 million evacuated; in over 66 cities damage ranged from 11% to 88%, with an average of 43% per city	3,150 <sup>b</sup>
3. Atomic bombing	6 Aug 1945	Hiroshima, Japan	about 75,000 (30%) killed, 75,000 injured	54
4. Atomic bombing	6&9 Aug 1945	Hiroshima & Nagasaki, Japan	Nagasaki: about 35,000 (16%) killed	248 <sup>c</sup>
5. (Same as 4)				... <sup>d</sup>

<sup>a</sup>Cross-section of population in U.S., British, and French occupation zones.  
<sup>b</sup>Nationwide cross-section of population.  
<sup>c</sup>128 in Hiroshima and Nagasaki, 120 in surrounding areas.  
<sup>d</sup>Reanalysis of USSBS interviews, with 55 for Hiroshima and 46 for Nagasaki.

Research agency and  
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Survey, Washington, D. C.

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Reports and references

- 1.1 U. S. Strategic Bombing Survey. The effects of strategic bombing on German morale. Washington: U. S. Government Printing Office, 1947. 2 vols.
- 2.1 U. S. Strategic Bombing Survey. The effects of strategic bombing on Japanese morale. Washington: U. S. Government Printing Office, 1947.
- 3.1 Kubo, Y. A study of A-bomb sufferer's behavior in Hiroshima: a socio-psychological research on A-bomb and A-energy. Jap. J. Psychol., 1952, 22, 103-108. (English abstract, 108-110)
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L. WORLD WAR II BOMBINGS (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
6. Atomic bombing	6&9 Aug 1945	Hiroshima & Nagasaki, Japan	Nagasaki: about 35,000 (16%) killed	n. g.

Research agency and  
principal research personnel

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Reports and references

The early "shielding histories" collected by Atomic Bomb Casualty Commission on Hiroshima and Nagasaki contain a narrative account of the survivors' perceptions and actions in the first few hours and days following the attack. These accounts range in length from 1/2 to 3 typewritten pages and appear in the last section of Atomic Bomb Casualty Commission Form No. ABC-32, "Experiences during and after bombing."

M. MISCELLANEOUS

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Damage</u>	<u>Number of interviews</u>
1. Porch collapse	17 June 1951	Chicago, Ill.	1 killed, 9 injured	11
2. Bleacher collapse	1952	Baltimore, Md.	5 to 10 injured	7
3. 4 events: S. S. Noric marine fire, flash flood, & apartment house fires in 2 differ- ent com- munities	1949- 1950	Canada (specific locations not given)	n. g.	n. g.

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Reports and references

- 1.1 Report on a porch collapse occurring in Chicago, Illinois, June 17, 1951. In E. S. Marks & C. E. Fritz, Human reactions in disaster situations. Unpublished report, Nat. Opinion Res. Center, 1954. Vol. 3, pp. 114-132.
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- 3.2 Tyhurst, J. S. Psychological and social aspects of civilian disaster. Canad. Med. Assn. J., 1957, 76, 385.

SUMMARY OF DISASTER FIELD STUDIES

<u>Disaster agents</u>	<u>Events studied</u>	<u>Field studies</u>	<u>Interviews and questionnaires</u>	<u>Reports</u>
A. Airplanes	4	3	176	7
B. Blizzards	3	2	19	2
C. Earthquakes, etc.	8	8	1,831 <sup>a</sup>	10
D. Epidemics and Epidemic Threats	5	5	2,487	7
E. Explosions and Fires	13	13	678 <sup>a</sup>	11
F. False Alerts	6	7	2,953 <sup>a</sup>	7
G. Floods	12	16	3,319 <sup>a</sup>	27
H. Hurricanes and Typhoons	12	9	364 <sup>a</sup>	9
I. Mine Disasters	2	3	297	5
J. Tornadoes	20	31	2,092 <sup>a</sup>	34
K. Toxicological Substances	8	8	227 <sup>a</sup>	6
L. World War II Bombings	4	6	7,163	4
M. Miscellaneous	<u>6</u>	<u>3</u>	<u>18</u>	<u>4</u>
Totals	103	114	21,624 <sup>a</sup>	121 <sup>b</sup>

<sup>a</sup>Approximate number.

<sup>b</sup>Inasmuch as 12 reports appeared in more than one category, the column total represents the total number of different reports.

**APPENDIXES**

Appendix A: LABORATORY STUDIES

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Description of event</u>	<u>Number of interviews</u>
*1. Simulated disaster	1950-1953	Rice Inst., Houston, Texas; FCDA headquarters, Olney, Md.	a sound pattern, designed to lead to an interpretation of threat, was presented to 2 groups of college students during lectures and 3 groups of FCDA trainees	302 <sup>a</sup>
*2. Shelter habitability test	Summer 1959	Princeton Univ., Princeton, N. J.	a family of 5 spent 14 days in simulated family fallout shelter	observation & monitoring
3. Shelter habitability test	3-17 Dec 1959	San Francisco, Calif.	100 adult males spent 2 weeks in experimental shelter	observation & 100 questionnaires
4. Shelter habitability study	Spring 1960	Pittsburgh, Pa.	four 30-person experimental groups inhabiting simulated shelter from one to two weeks	120 <sup>b</sup>

\*Supported by Disaster Research Group.

<sup>a</sup>"Questionnaires were distributed to the audience and later followed up with interviews. Moving pictures, in some instances, have been taken." 65 interviews and 237 questionnaires reported.

<sup>b</sup>Each of the 120 persons filled out questionnaires and then they were interviewed. Monitoring and observational techniques were also used.

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Reports and references

- 1.1 Hudson, B. B. Anxiety in response to the unfamiliar. J. soc. Issues, 1954, 10 (3), 53-60.
- 1.2 Hudson, B. B., McDavid, J., Roco, Marian. An experimental study of mass fear. Houston: Rice Inst., n. d.
- 2.1 Vernon, J. Project Hideaway: a pilot feasibility study of fallout shelters for families. Washington: U. S. Government Printing Office, 1960.
- 3.1 Goldbeck, R. A., & Newman, P. H. Habitability test of the NRDL 100-man shelter. Santa Barbara, Calif.: Amer. Inst. for Research, 1960.
- 4.1 Altman, J. W., Smith, R. W., Meyers, Rheda L., McKenna, F. S., & Bryson, Sara. Psychological and social adjustment in a simulated shelter. Pittsburgh: American Inst. for Research, 1960.

Appendix B: CIVIL DEFENSE EXERCISES

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Description of event</u>	<u>Number of interviews</u>
1. Mock air attack: Operation Defense	8 Oct 1951	Chicago, Ill.	simulated bombing of the Loop and near North Side by Air Force and Navy planes with demonstration of anti-aircraft defense and fire fighting techniques	observation and informal interviews with street crowds by 5 trained observers
*2. Evacuation exercise: Operation Walkout	26 Apr 1954	Spokane, Wash.	walkout evacuation of about 11,000 from central business district of city to peripheral bus loading stations	observation
*3. Evacuation exercise: Operation Seat	14 Jun 1954	Mobile, Ala.	drive-out evacuation of about 90,000 from wharf, industrial, residential, and downtown business areas	observation
*4. Alert exercise: Operation Alert 1954	14 Jun 1954	Washington, D.C.	public civil defense test drill	observation
*5. (Same as 4)	14-15 Jun 1954	FCDA communication & control centers	study of communication & human behavior problems during alert exercise at two national centers: "High Point" and "Low Point"	participant observation

\*Supported by Disaster Research Group.

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Appendix B: CIVIL DEFENSE EXERCISES (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Description of event</u>	<u>Number of interviews</u>
*6. Evacuation exercise: Operation Rideout	24 Jun 1954	Bremerton, Wash.	evacuation of city of 28,000 by private vehicles, public transportation, & school buses	observation
7. Evacuation exercise: Operation Driveout	17 Oct 1954	Erie County, Pa.	evacuation of 175,000 by automobile from 60-sq.-mile area	observation
8. Evacuation exercise: Operation Go Home	12 Nov 1954	Albany County, N. Y.	evacuation of downtown area of 65,000	observation
9. Evacuation exercise: Operation Scram	23 Nov 1954	Philadelphia, Pa.	walk-out evacuation of about 25,000 from offices in 20-block area in central Philadelphia to distribution point a half-mile away	633*
10. Evacuation exercise: Operation Kids	15 Mar 1955	Mobile, Ala.	including 46,000 participants, 39,000 school children, driven by about 6,000 drivers to a perimeter 10 miles outside city	1,987 questionnaires

\*Supported by Disaster Research Group.

#580 questionnaires ("evacuees"), 31 interviews (gatekeepers), 42 observer reports.

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Appendix B: CIVIL DEFENSE EXERCISES (Continued)

<u>Event</u>	<u>Date</u>	<u>Location</u>	<u>Description of event</u>	<u>Number of interviews</u>
*11. Alert exercise: Operation Alert 1955	15-16 Jun 1955	FCDA communication & control center	decision-making & other human problems during alert exercise in national control & communication center: "Low Point"	participant observation

\*Supported by Disaster Research Group.

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