DEFENDING THE UNITED STATES FROM NUCLEAR FIRE

A RESUME' of the Final Report of the

National Fire Coordination Study

DIVISION OF FIRE CONTROL/FOREST SERVICE/U.S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C. 20250

The National Fire Coordination Study was conducted by the Forest Service, U. S. Department of Agriculture, for the Office of Civil Defense under Project Order OCD-PS-64-229. Its objectives were to:

1. Review pertinent research findings and define the nuclear fire problem.

2. Recommend a nationwide fire defense program, including alternatives, for the Office of Civil Defense.

3. Recommend how the several parts of the fire defense program should be implemented.

This paper is a resumé of the final report.

CONTENTS

DEFENDING THE UNITED STATES FROM NUCLEAR FIRE

A resumé of the final report of the National Fire Coordination Study

By

William R. Moore, James W. Jay, and John H. Dieterich

INTRODUCTION

During World War II all of the major powers used fire to inflict destruction upon their adversaries. Fire gutted communities, took lives, and destroyed resources. In July and August 1943, Hamburg, Germany, was more than half destroyed by aerial bombardment; three quarters of the damage was by fire.

Fire devastated many cities during the war. From a scattered haphazard beginning, fire use developed into planned incendiarism that was primarily responsible for urban destruction. The climax came with the atomic attacks on Hiroshima and Nagasaki. Here two great cities were almost completely eliminated by the fire and blast from a single bomb dropped on each. Meanwhile, American cities and countrysides remained undamaged, quite removed from the threat of war.

In this day of intercontinental ballistic missiles and thermonuclear warheads, an attack could quickly convert the bustling peacetime American scene into embattled front lines. If this happens, could the fire services control the fires while hampered by rubble, broken water mains, and radioactive fallout and harrassed by numerous thermal ignitions? Studies made of large fires during the past few years indicate that in many cases they could not. What then can be done before, during, and after an attack to confine the damage from nuclear fire to acceptable proportions? This heretofore unanswered question prompted the National Fire Coordination Study, conducted by the U. S. Forest Service for the Office of Civil Defense (OCD).

Cooperating in the Study from the beginning were experts from urban and rural fire services, supporting groups, and fire educational organizations.

The Study

The Study began in July 1964 with orientation meetings in Los Angeles, Portland, Chicago, Boston, and Memphis among urban and rural fire leaders and other interested persons. Later, related operational studies were reviewed and their recommendations considered. To obtain samples of present fire planning and readiness activities, fire mutual aid arrangements were studied in California, Oregon, Michigan, Massachusetts, and the Washington, D. C., Metropolitan Area. Tactical fire control practices and problems were examined and related to the defense of fallout shelters by studying 12 large fires. Nuclear attacks of varying degrees and types were hypothetically employed upon the United States to define the scope and complexity of the nuclear fire problem. Pertinent research findings were then summarized and applied to the attacks.

Thus, the Report brings together research in nuclear fire and damage potential from attack, information from mutual aid, large-fire, and administrative studies, and the thinking of many fire leaders across the Nation.

THE PROBLEM

Damage from a nuclear attack would be caused primarily by blast, radioactive fallout, and fire. Fires would be started by thermal flash from the nuclear warheads and by broken power lines, overturned stoves, and similar disruptions resulting from the blast. Blast causes severe destruction in a limited area but is incapable of spreading beyond the area of initial damage. Radioactive fallout and fire not only inflict damage in the blast area, but spread beyond to threaten additional lives and resources.

Climate and weather, spacing and flammability of fuels, and to a lesser extent topography influence the ignition and spread of fire. The most serious fire threat would develop from many small fires burning together and creating large fires capable of threatening fallout shelters and needed resources.

What, then, can be done before, during, and after an attack to reduce the damage from nuclear fire?

Because lethal doses of radioactive fallout from a nuclear attack could cover large areas of the United States, the fallout shelter program is recognized as the most fundamental life-saving measure in Civil Defense. After an attack, however, spreading fire could threaten some shelters and force survivors to defend the shelters or expose themselves to fallout in order to escape the fire. These shelters must be protected, whether from fires starting within the shelter, spreading from other buildings, or spreading from forest fuels. Depending upon weather conditions and size and nature of attack, as much as 10 percent of the land area of the United States could burn. (fig. 1)

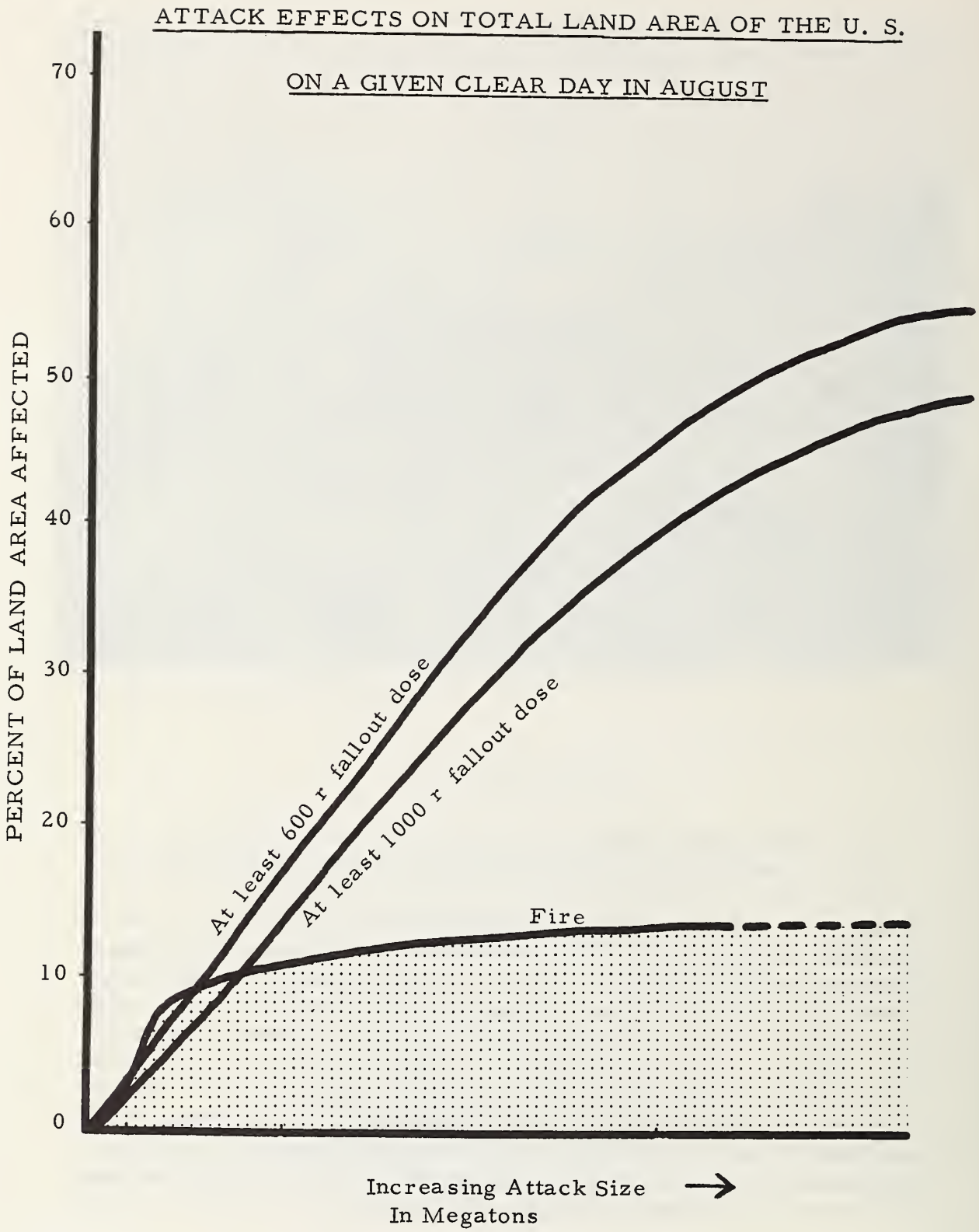
ATTACK EFFECTS ON TOTAL LAND AREA OF THE U. S.
ON A GIVEN CLEAR DAY IN AUGUST
PERCENT OF LAND AREA AFFECTED
70
60
50
40
30
20
10
0
At least 600 r fallout dose
At least 1000 r fallout dose
Fire
Increasing Attack Size
In Megatons

Figure 1

"Tactical fire control practices and problems were examined and related to defending fallout shelters by studying large fires."

Damage from nuclear attack would be caused primarily by blast, fallout, and fire.

Wartime Fire Defense Differs From Peacetime

The most serious complication introduced by nuclear weapons is fallout that could interfere with firefighting and the movement of people. The presence, anticipated presence, and duration of radioactive fallout would control the timing of any activities outside the protection of fallout shelters. Also, broken water mains and rubble would reduce the effectiveness of conventional firefighting equipment. In some areas fires would be so numerous that available trained firefighting forces would be quickly overwhelmed if they attempted to control them all. Consequently, fires that threaten lives or resources needed for survival must receive priority. Citizen action to remove combustible materials, cover ignitable home furnishings, and to put out small fires are an important auxiliary to organized fire defense.

Urban and rural fire forces would be joined together – much oftener than they are in peacetime – to fight the common enemy, nuclear fire.

Disaster areas created by nuclear attack would be so large that urban and rural fire forces would need to join together – much oftener than in peacetime – to fight the common enemy, nuclear fire. This requires joint urban-rural planning and training, especially in areas where rural fuels capable of spreading fire are adjacent to urban areas.

Expanded Capability is Needed

Organized fire services in the U. S. are effectively protecting urban areas and all but about 500 million acres of rural land. Personnel of these services are competent firemen, equipped and trained to act independently and effectively. Given guidance, support, and training in nuclear aspects of fire, they can provide fire defense leadership to the public and take preparedness, selective fire control, and related rescue actions that will reduce significantly the nuclear fire threat. The foundation of our Nation's strength for fire defense in nuclear war is the organized fire service. These firemen, and the populace, must face the fire threat independently until it is possible to arrange aid to stricken communities. Understanding by both public officials and citizenry of the size and complexity of the nuclear fire problem is the first step toward reducing the fire threat. Such understanding is not widespread in the U. S. today.

THE PROGRAM —
Wartime Protection and Peacetime Benefits

The nuclear fire threat is serious but manageable. By using existing fire protection capability as the foundation, fire defense readiness can be developed through training, special fire analysis of each community, fire defense plans, and protective measures as shown in figure 2. The protective measures were identified by the Study as capable of supplementing the fire services in preparation for defense against nuclear fire. They form the proposed nationwide fire defense program (table 1).

The program would begin with issuance of nationwide guidance (part E, chapter 10, Federal CD Guide). A minimum number of citizens and firemen would be trained to protect shelters and critical resources from nuclear fires. OCD would sponsor national-level leadership training, prepare and distribute training materials and aids to fire services and organizations, and develop TV and radio instruction kits to be kept ready at national networks and key locations in each state. The TV and radio instruction kits would be used to instruct citizens on occasions of increased international tension or during fire prevention week drills.

A special nuclear fire analysis system is recommended that would provide planning data for each community. Nationwide planning efforts would be guided by a National Fire Defense Plan.

Development of an infrared mapping system — to become part of a nationwide intelligence system — would continue. Special studies would provide data for developing nationwide intelligence and communications systems. A system for assessing damage from nuclear fires would be installed. OCD would prepare guides for community planning to eventually reduce the fire vulnerability of cities.

The fire vulnerability of each community fallout shelter would be determined by inspection. Corrective action would be included in a fire defense plan for each shelter. As necessary, fire suppression equipment and auxiliary water would be placed in each shelter, and a fire guard trained to help the shelter manager carry out the fire plan. When indicated by the inspection, corrective action would include fireproofing the roofs of buildings that house shelters.

Fire control and associated rescue during a nuclear attack would be strengthened through training, air operations, and improved fire resource locator equipment.

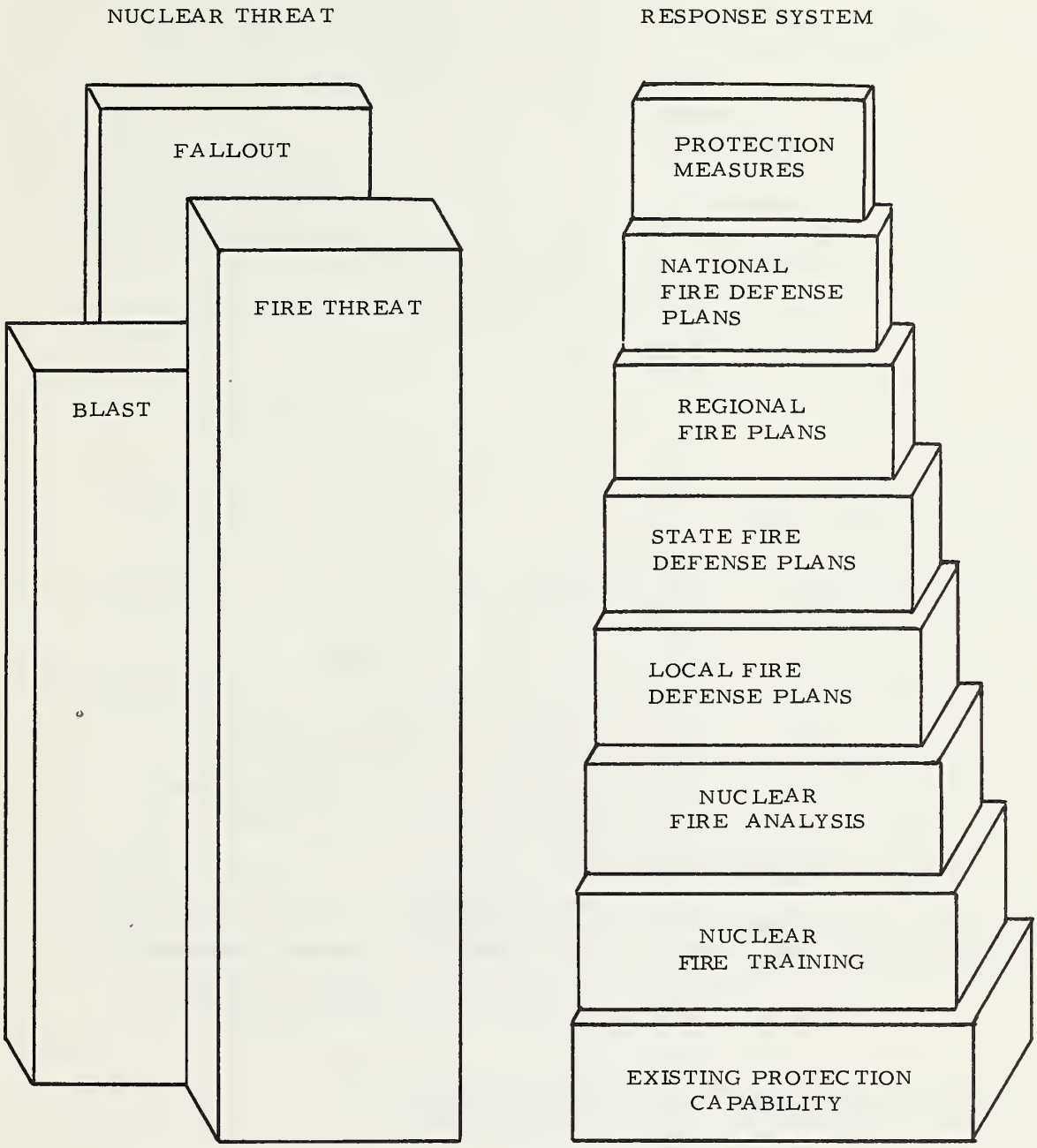

Figure 2 The response system, with components based on the existing capability, must equal the nuclear fire threat.

Table 1

PROPOSED COMPONENTS OF THE FIRE DEFENSE PROGRAM

-FIRE DEFENSE INSTRUCTIONS (Federal Civil Defense Guide)	1. Part E, chapter 10, Fire Defense 2. Appendix 1, Nuclear Fire Analysis System 3. Appendix 2, National Fire Defense Plan 4. Appendix 3, Fire Defense Training 5. Annexes as necessary
-FIRE DEFENSE TRAINING	1. Advanced nuclear fire leadership training 2. Basic nuclear fire defense training 3. Urban fire defense support fireman training 4. Shelter fire defense training 5. Householder self-help training 6. Shelter inspection & rating training 7. Rural fire defense training 8. Fire research seminars
-CITIZEN ACTION	1. Citizen fire extinguishing prevention 2. TV & radio information kit
-NUCLEAR FIRE ANALYSIS	1. Nuclear fire analysis system
-FIRE DEFENSE PLANS	1. National fire defense plan 2. Regional, State & local fire defense plans 3. Shelter fire defense plans
-SUPPORT ACTIVITES	1. Infrared mapping of nuclear fires 2. Guidelines for community planning 3. Nationwide fire intelligency system 4. Nationwide fire communications system 5. Fire damage assessment system
-SPECIAL PREPARATIONS FOR DEFENDING SHELTERS	1. Shelter fire guards 2. Shelter inspection & fire vulnerability rating 3. Fire suppression equipment in shelters 4. Fireproof roofs for shelter buildings 5. Auxiliary water supplies in shelters
-EMERGENCY OPERATIONS	1. Fire resource locator 2. Air operations

When fully implemented, this program would reduce the threat from nuclear fire to acceptable limits and would reduce losses of life and property experienced in peacetime. It would harmonize with the objectives and procedures of other Civil Defense endeavors.

JOINT ACTION IS NEEDED

Because potential nuclear fire is both a local and nationwide threat, the combined efforts of OCD, the fire services, fire supporting groups, fire educational organizations, industry, Federal, state, and local governments and citizens are needed to implement the fire defense program. But support and participation in the program cannot be expected until the participants understand the nature and extent of the nuclear fire problem and its relationship to peacetime fire activities. Thus, as a first step, it is necessary to conduct basic nuclear fire defense training.

National leadership is necessary to coordinate the work of each participant with the program's objectives. This leadership will be by the Departments of Defense, OCD, and Agriculture, FS, as required by the Federal Civil Defense Act of 1950 as amended, and by Presidential executive orders issued to each Department.

The National Fire Defense Plan would describe responsibilities, objectives, and organization of fire defense activities at all levels of government. It would describe alternative methods of organizing fire operations at emergency operation's centers to permit expansion as required. Fire defense coordinators are recommended by the Study for local jurisdiction, for zones within the states, for states, inter-state regions, and at national headquarters. Coordination of readiness activities would be further enhanced by establishing a National Fire Defense Advisory Committee to advise the Office of Civil Defense. The existing Rural Fire Defense Committee, which advises the Forest Service, would continue as a sub-unit of the National Committee.

A Mutual Aid Policy is recommended to encourage states to enact legislation permitting governors to authorize easy interchange of fire forces and personnel within each state and between states. The policy would encourage mutual aid and training between urban fire services, state and local rural fire services, and Federal fire services. It includes cost sharing by OCD for planning extraordinary arrangements for nuclear fire.

THE TASK AHEAD

Although important fire defense efforts are already underway, substantial additional preparations are necessary for the proposed program. Before training can begin, materials and aids for training firemen, citizens, and civil defense officials must be prepared and tested. Ways to evaluate the results of training must be arranged. The Nuclear Fire Analysis System has to be developed. To make the National Fire Defense Plan fully effective, sample local plans should be prepared and made available to the states. Guidelines for inspecting and rating the fire vulnerability of fallout shelters are necessary, as are plans to guide the development of nationwide fire communications and intelligence systems. Infrared mapping, the fire resource locators, and use of aerially delivered fire retardants in urban areas require additional development. Several important fire annexes to the Federal Civil Defense Guide remain to be written. Moreover, to solve special problem and strengthen fire defense, continuing research is needed.

How rapidly should the fire defense program be implemented? There are many complex tasks. It is necessary to begin now to be fully underway 3 years hence, and there would be much work after that to achieve the full potential of each measure. Our Nation's security is partly at stake. Time is important. And in this nuclear age, time waits for no country.

REFERENCES

Reports prepared by the National Fire Coordination Study staff and their contractors are listed below. The final report of the Study includes a complete bibliography.

Bio-Dynamics, Inc.

1966 Recommendations for subsequent development and other applications of disaster control center equipment

_____ 1966 State-of-the-art in disaster control display systems

_____ 1964 Study of mutual aid systems in New England area, (Report prepared for NFCS, U. S. Forest Service)

Colvill, L., and Jay, J. W.
1964 Portland mutual aid study report, (NFCS, U. S. Forest Service)

Crowley, J. W., Letts, M. H., and Stahl, F. G.
1965 Role of the fire services in nuclear war, (Report prepared for NFCS, U. S. Forest Service)

Dieterich, J. H.
1966 Research summary and analysis II, (NFCS, U. S. Forest Service)

_____
1965 Selected disaster summary, (NFCS, U. S. Forest Service)

_____
1964 Park headquarters fire, South Dakota, (NFCS, U. S. Forest Service)

_____
1964 Combined fire analysis, (NFCS, U. S. Forest Service)

_____ and Crowley
1965 General dynamics fire, (NFCS, U. S. Forest Service)

_____ and Gratz, D. B.
1965 Russwood ball park fire, (NFCS, U. S. Forest Service)

_____
1965 Boston fires, (NFCS, U. S. Forest Service)

_____
1964 Deadwood fire, South Dakota, (NFCS, U. S. Forest Service)

Jay
1966 The 1959 explosion and fire, Rosebury, Oregon (NFCS, U. S. Forest Service)

_____
1964 Nevada fires, (NFCS, U. S. Forest Service)

Lockhart, R. E., and Jay
1964 Washington, D. C. metropolitan area mutual aid study, (NFCS, U. S. Forest Service)

Moore, W. R.
1964 Analysis of past recommendations, (NFCS, U. S. Forest Service)

_____ 1964 Fire service briefing meetings, (NFCS, U. S. Forest Service)

_____ 1964 Rural fire defense training - project 107, (NFCS, U. S. Forest Service)

_____ and Jay
1964 Combined mutual aid analysis, (NFCS, U. S. Forest Service)

_____, Jay, and Dieterich
1965 Support data, (NFCS, U. S. Forest Service) (SECRET)

_____ 1965 Phase one report, (NFCS, U. S. Forest Service)

_____ 1965 Analytical report, (NFCS, U. S. Forest Service) (CONFIDENTIAL)

National Fire Coordination Study
1965 Fire defense in the United States, (U. S. Forest Service)

_____ 1964 Problem solving in the analytical phase, (U. S. Forest Service)

_____ 1964 Study of large fires, (U. S. Forest Service)

Royer, Keith, and Nelson, F. W.
1964 Existing mutual aid and command situation in Michigan, (Report prepared for NFCS, U. S. Forest Service)

Storey, T. G.
1966 Los Angeles riot fires, (NFCS, U. S. Forest Service)

_____
1965 Coyote fire, California, 1964, (NFCS, U. S. Forest Service)

_____
1965 Santa Rosa fires, (NFCS, U. S. Forest Service)

_____ and Dieterich
1965 Fire bibliography, (NFCS, U. S. Forest Service)

_____
1964 Research summary and analysis, (NFCS, U. S. Forest Service)

_____ and Harrison, C. L.
1964 California, Los Angeles mutual aid study, (NFCS, U. S. Forest Service)

_____ and Noel, S. M.
1966 Large fires in the world since 1825, (NFCS, U. S. Forest Service)

System Sciences Co., Bethesda, Md.
1964 The fire problem in nuclear war, (Report prepared for NFCS, U. S. Forest Service) (CONFIDENTIAL)