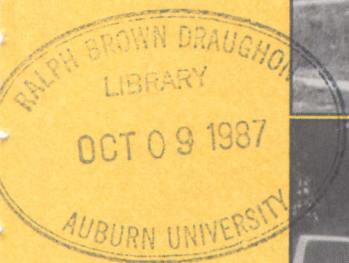
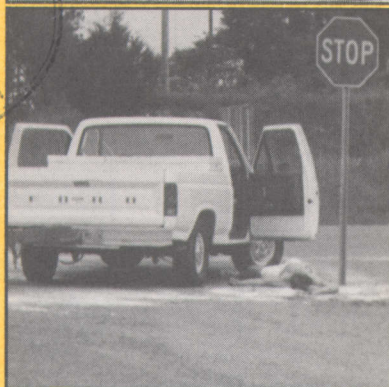


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HAZARDOUS WASTE AND

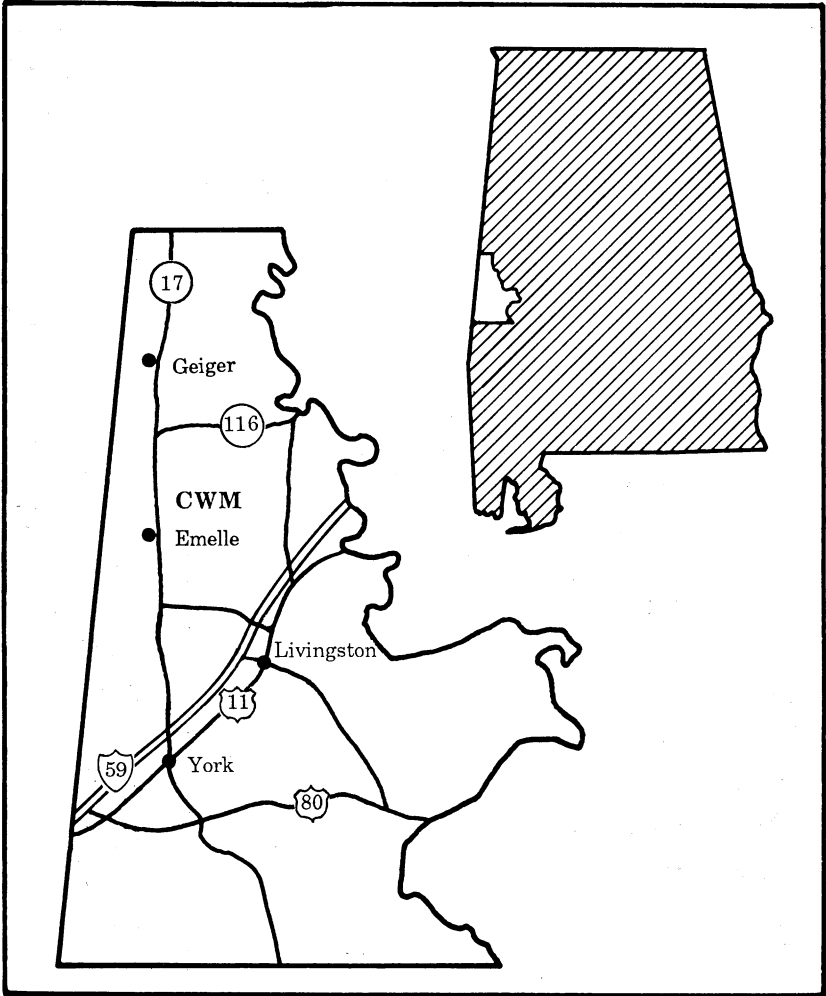


EMERGENCY PLANNING

A Case
Study
of
Sumter
County,
Alabama

Alabama Agricultural Experiment Station Auburn University
Lowell T. Frobish, Director Auburn University, Alabama





Location of Sumter County, Alabama, and Chemical Waste Management, Inc., near Emelle in that county.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

<i>Planning principle</i>	<i>Findings</i>	<i>Recommendations</i>
1. Planning is a process	Overall lack of formalized planning	Formalized planning on part of all organizations
	Lack of mechanisms to facilitate planning	Periodic updating and testing of plans
2. Specify task responsibilities	Officials knowledgeable of emergency roles	Periodic planning workshops
	Lack of personnel and resources	Increased personnel and resources
3. Inter-agency relationships	Informal coordination exists	Provision for multi-agency planning workshops
	Mutual aid agreement exists	Assign ADEM responsibility for reporting on-site incidents
	Lack of formalized planning process to specify inter-agency relationships	
4. Recognize public response	Public uninvolved in emergency preparedness	Provide public workshops
		Publicize disaster drills
5. Comprehensive planning	Comprehensive for agent types	Integrate urban planning office, Department of Human Resources, and similar organizations into emergency planning process
	Weak on mitigation and recovery phases	

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Information contained herein is available to all without regard to race, color, sex, or national origin.

HAZARDOUS WASTE AND EMERGENCY PLANNING

A Case Study of Sumter County, Alabama

CHARLES E. FAUPEL, CONNER BAILEY, and MARCUS WILLIAMS^{1,2}

INTRODUCTION

Someone once suggested that Noah, with his ark, was the first disaster planner. He anticipated a threat, having a somewhat unusual and personalized warning system. Certain consequences seemed probable.... He projected his manpower needs and had the capability to mobilize the necessary personnel. When the threat was realized, he rode out the storm in reasonable safety and, in not too many days, was ready to start on the recovery stage... (3, p. 1)

CONTEMPORARY EMERGENCY PLANNERS continue to confront many of the same planning problems and issues as Noah, though not always as successfully. Emergency management has become a profoundly more complex enterprise in subsequent millenia, owing largely to the growing complexity of society itself. Contemporary emergency management entails the coordination of a variety of relevant emergency organizations. Moreover, not only must contemporary emergency planners anticipate a multiplicity of potential natural hazards, but, unlike Noah, their job is further complicated by the threat of *technological* emergencies as well. Technological progress has brought with it vulnerability to new sources of man-made danger, including explosions, radioactive contamination, and catastrophic accidents involving toxic and carcinogenic chemicals, to name just a few.

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²The authors thank Pat Neuhauser of the Sumter County Emergency Management Agency and the Disaster Research Center of the University of Delaware for their generous assistance in facilitating the fieldwork involved in preparing this report.

This report is designed to focus attention on problems associated with handling and disposing of hazardous materials in Alabama, with specific reference to emergency planning and preparedness in small towns and nonmetropolitan counties. Hazardous materials are produced and used in both urban and rural settings, but hazardous waste products are more likely to be disposed of in sparsely populated rural areas than in urban areas. The basic question addressed in this report is: "How prepared are the small towns and nonmetropolitan counties of Alabama to handle an emergency involving hazardous materials?" To answer this question, the authors adopted a case study approach involving a detailed study of Sumter County, Alabama, site of the nation's largest hazardous waste treatment and disposal facility.

As with any case study, there are unique characteristics associated both with Sumter County and with hazardous wastes as distinct from hazardous materials (e.g., chlorine gas) which may be far more dangerous than waste products coming from industrial generators. However, a case study approach based on detailed interviews and familiarity with local conditions provides opportunity for examining personal and organizational dynamics associated with emergency planning and preparedness. At this level, it is likely that findings from Sumter County will reflect conditions elsewhere in Alabama and thus may be helpful to local authorities and citizen groups. Moreover, the principles of emergency preparedness discussed in this paper transcend both location-specific differences and differences between hazardous wastes and hazardous materials.

Hazardous waste management has become an increasingly important concern at both the state and national level. In the United States, approximately 250 million tons of hazardous wastes are generated each year (12) or (as frequently put) approximately 1 ton for every man, woman, and child in this country. Until about a decade ago, disposal of such waste was handled in an *ad hoc* and piecemeal fashion as industrial plants and other producers of hazardous waste simply dumped it in the most economically efficient way possible, often on their own premises.

It was not until 1965, with passage of the Solid Waste Disposal Act, that Congress officially recognized that waste materials posed a threat to the environment. While this was a landmark piece of legislation, it was limited to providing research funds and technical assistance to state, county, and city planners. The Resource Recovery Act of 1970 expanded the substantive focus of the 1965 legislation, promoting the use of sanitary landfills, conservation measures, and

recycling technologies. The threat of hazardous waste as a specific focal concern was overlooked until 1976, when the Resource Conservation and Recovery Act (RCRA) was passed. This piece of legislation, enforced by the Environmental Protection Agency (EPA), set minimal standards for the processing, transfer, and ultimate disposal of hazardous waste products. These RCRA standards, which were made even more stringent in 1984, effectively necessitate the transfer of hazardous waste materials by some 175,000 businesses to central disposal facilities (16).

The largest of these facilities in the United States is operated by Chemical Waste Management, Inc., in Sumter County, Alabama. Sumter County is a largely rural county with a population of 16,908. Its largest concentration of population is in the cities of York (population 3,392) and Livingston (the county seat, population 3,187), both located in the southern portion of the county (20). The waste disposal facility is located in the sparsely populated northern sector of the county, between the small communities of Emelle and Geiger (see map). The waste facility was established in 1976 by Resource Industries, Inc., a small company owned and controlled by a group of regional investors. Chemical Waste Management, Inc. (popularly known as "Chem Waste"), a subsidiary of the multi-national Waste Management, Inc., headquartered in Oak Brook, Illinois, bought Resource Industries' interests in 1978 and has operated the site since that time.

Potential Environmental Threats

Concentration of large amounts of hazardous materials moving towards and disposed of within a single location poses two kinds of potential environmental threats—chronic threats and acute threats.

Chronic Threats

Chronic threats to human health and the environment include groundwater and aquifer contamination, occasional atmospheric releases, and toxic exposure of workers handling these materials. These risks constitute a sufficient threat to require on-going monitoring by the Environmental Protection Agency (EPA) and the Alabama Department of Environmental Management (ADEM).

Acute Threats

While less frequent in nature, acute threats pose potentially catastrophic risks. Explosions may occur, for example, if two otherwise

non-volatile substances accidentally come into contact. A major on-site accident which could endanger the health and lives of hundreds of workers and residents in the surrounding area, however unlikely, is not inconceivable. The increased volume of traffic transporting hazardous materials on the narrow two-lane state and county highways and on local waterways raises the possibility of major accidents and subsequent release of large volumes of hazardous and toxic substances. Scenarios such as these must be anticipated and require careful contingency planning. Indeed, as this report is being written, the town of Aliceville in neighboring Pickens County is considering a municipal ordinance which would restrict the movement of hazardous materials on grounds that local authorities lack the capacity to effectively respond to such an accident.

While both chronic and acute threats are of concern to those responsible for environmental management, emergency preparedness traditionally has focused primarily on acute threats. This too will be the focus of this report, recognizing that although small but chronic releases of hazardous materials may pose a greater long-term threat to the environment, more massive accidental releases of such materials pose more immediate acute human health risks.

Although Sumter County hosts the only off-site hazardous waste facility in Alabama, the implications of this study extend far beyond that county. Within Alabama, there are hundreds of industrial facilities which use hazardous materials and dispose of hazardous wastes on an on-site basis. Communities which host such industries confront many of the emergency preparedness issues facing Sumter County. Moreover, the Emelle facility is but one of several off-site hazardous waste facilities located throughout the United States. It is hoped, therefore, that the lessons from the following analysis of the largest of these sites will facilitate emergency preparedness for hazardous wastes not only throughout Alabama, but nationally as well.

Principles of Emergency Planning

A Continuous Process

Too often emergency planning is approached as a one-time event of "writing a plan." The temptation is great to regard the written plan as a panacea for the various emergency situations that may arise. The written plan is only the beginning, not the end result of successful planning (17).

A "process" model of planning implies, first, assignment of responsibilities to *positions* as opposed to individuals. Delegation of responsibilities to positions allows for greater continuity of role per-

formance in the face of personnel turnover. Second, understanding planning as “process” rather than “product” entails frequent updating of the written plan (3). Any number of factors necessitate regular revision of the written plan. Changing technologies and routine procedures, adding or deleting organizational positions, and changing role definitions of existing positions (job descriptions) must all be acknowledged in emergency plans. In addition, factors external to the focal organization itself may require updating. State and federal legal changes are particularly relevant to hazardous waste emergency planning. In addition, changing transportation routes, shifting demographic patterns, the closing of a hospital or ambulance service, or the shift to a 911 emergency system all may affect the relevance of existing emergency plans. Moreover, flaws may be revealed through testing or implementing the plan.

Third, a process model of emergency planning provides for the frequent testing of the written plan (3,14,22). The best formulated written plan cannot possibly account for all possibilities which may affect implementation. “Dry runs” can be invaluable in revealing potential planning flaws and in suggesting necessary corrective action. Relying on an actual emergency situation to test the plan could prove disastrous.

Finally, a process orientation to emergency planning will include provision for training and education (3). Key personnel, both in the focal organization and in related community organizations, must be educated regarding their own and related response roles. In addition, the public must be adequately educated regarding appropriate responses on their part to certain broadly defined kinds of emergencies.

Should Clearly Specify Task Responsibilities

Emergency response in the United States involves a multiplicity of organizations with specialized and in some cases unique functions. Many of their responsibilities during an emergency are merely extensions of routine activities. Law enforcement agencies, for example, assume responsibility for crowd control, managing convergence, and maintaining security. Similarly, fire departments find themselves engaged in many of the same activities in a community-wide disaster as they do in routine emergencies.

Emergencies of community-wide scope, however, often pose special demands not encountered in routine activities. Some of these demands involve “extended” responsibilities which, while similar to routine tasks, impose certain strains on the organization. Special

equipment may be required; personnel requirements are typically expanded considerably, often necessitating the use of volunteers; increased demands on organizations also frequently necessitate altering and/or broadening channels of authority within the organization. Moreover, large-scale emergencies often pose "emergent" demands which are not familiar to an organization's daily routine, sometimes resulting in confusion. Both fire and police departments find themselves issuing warnings, conducting evacuation procedures, and engaging in search and rescue activities. In such situations, hospitals frequently encounter the problem of convergence, and find it necessary to deploy personnel for public relations roles to control the inundation of friends and relatives seeking information regarding the status of victims. Such demands require that each organization in the community have a clear understanding of both their extended and emergent responsibilities in a major emergency. Furthermore, it is essential that tasks be clearly understood by incumbents in key organizational positions. Hence, interviews with local officials are scrutinized to assess the salience of these role responsibilities.

Should Recognize Inter-Agency Relationships

As organizations develop their individual emergency plans, it is easy to become preoccupied with detailed information on the role of the focal organization itself. There are, to be sure, certain intra-organizational matters that must be addressed in the written plan, such as those suggested above. Even more problematic, however, is missing the forest for the trees by failing to recognize the inter-organizational context within which emergency response must take place (3,4,22).

The central coordinating agency for all emergency response within a county is the Emergency Management Agency, formerly known as the Civil Defense (2). Beyond the county Emergency Management Agency, however, responding organizations are intricately related in a web of complementary, though sometimes conflicting, role responsibilities. Each of these respective organizations operates with at least implicit expectations of other related organizations. Police and fire departments, for example, which are mandated the responsibility of search and rescue in major disasters, are dependent on the receptivity of local hospitals for casualty victims. By contrast, organizations with similar role responsibilities often find themselves in competition with other organizations which share those responsibilities. In either case, explicit recognition of the related roles of alternative organizations is fundamental to successful planning.

In the case of emergencies related to hazardous wastes, the locus of the emergency is likely either the hazardous waste facility itself or the transportation arteries leading to it. Consequently, while the facility has not been formally designated the responsibility of inter-organizational coordination, its unique geographical position with respect to the disaster agent requires that it explicitly recognize the task responsibilities of the various relevant organizations (17). Similarly, police, fire, ambulance, and other organizations sharing responsibility for initial response must be cognizant of the task responsibilities of other agencies responding to the scene. Furthermore, there are a number of "vertical" (extra-local) relationships which must be addressed in such a plan (17). The local facility is typically a subsidiary of a larger national organization, as is the case in Sumter County. In addition, there are a number of federal and state organizations, most notably the Environmental Protection Agency (EPA), the Federal Emergency Management Agency (FEMA) (21), and, in the present case, the Alabama Department of Environmental Management (ADEM), which impact on the local response effort.

Should Account for Likely Public Response

Emergencies of large-scale proportion profoundly affect the general public. The public, therefore, is also an actor in the emergency response system. Unfortunately, the nature of public response has been too little understood in planning efforts in the past (3,22). Fears of a panicking public, for example, have led many officials to withhold emergency information in an effort to forestall such "competitive flight" behavior. Decades of research, however, have revealed that such fears are unfounded, and that the greater problem in a disaster situation is motivating people to evacuate (4,9,18). Another unanticipated public response is the convergence of people, supplies, and phone calls by curiosity seekers, concerned friends and relatives, and others seeking information or wanting to be of help in responding to the emergency (6,17). Informed emergency planning reflects this phenomenon and leaders may even be able to use such interest to advantage by specifying tasks for which volunteers can effectively be used. Failure to anticipate likely public response may thwart effective organizational and community response.

Should be Comprehensive

Account for Likely Disaster Scenarios. While most plans do not err by overemphasis on *unlikely* emergencies, it is more common to overlook likely disaster agents. Hence, while it is certainly necessary to

recognize and plan for the event of accidental toxic releases and explosions, emergency planning in hazardous waste host communities should also anticipate the possibility of floods, fires, tornadoes, and hurricanes, all of which may cause or exacerbate the release of toxic materials into the environment (3,5).

Address All Emergency Phases. The Federal Emergency Management Agency (5) has identified four broad phases of emergency management, known collectively as the Integrated Emergency Management System (IEMS) (see also 1,8,15,23). These phases are mitigation, preparation, response, and recovery. Mitigation involves all of those considerations which reduce the likelihood of an emergency situation occurring in the first place. Mitigation measures related to the handling of hazardous wastes are carefully detailed in EPA regulations and permits and should be integrated into the standard operating procedures of the hazardous waste industry. Preparation entails such considerations as warning and stockpiling of relevant supplies and equipment. Response activities, by contrast, include search and rescue, evacuation, and, in the case of waste related emergencies, containing toxic releases and extinguishing fires. Recovery involves those extended activities necessary to bring the community back to a state of normalcy, including provision for long term financial assistance and, particularly relevant to chemical hazards, the existence of sufficient liability insurance on the part of the chemical industry. Finally, in addition to these "phase-specific" considerations, effective planning should provide a mechanism for continuous assessment of the emergency situation.

OBJECTIVES AND METHODS OF STUDY

This publication reports part of a larger research endeavor which seeks to examine (1) the extent of public involvement in decision-making processes regarding hazardous waste management in Alabama, and (2) the impact of the hazardous waste industry on local communities in Alabama. In the context of the second of these broad goals, the present analysis of local emergency planning is understood to be one measure of the extent to which potential *negative* impacts of the hazardous waste industry on local communities are mitigated. That is, rigorous emergency preparedness serves to limit the potential negative consequences endemic to the handling of large volumes of hazardous wastes; where such preparation is lacking, the result could be devastating.

Fortunately, decades of research have revealed a number of prin-

ciples characteristic of successful emergency planning (3,4,5,6,10). While these principles have evolved from studies of natural disasters, they are sufficiently generic to be applied to emergencies related to the hazardous waste industry as well. Some of the more salient planning considerations were previously discussed as a framework for assessing emergency preparedness in Sumter County. Beyond this assessment, the objectives of this study are to apply these principles of emergency planning and preparedness as a useful planning framework for municipal, county, and state level officials with responsibilities that include public safety and health as well as environmental management. In addition, the authors expect that various citizen groups which focus their attentions on environmental concerns will find the insights contained herein to be useful.

Two types of data comprise this analysis of the emergency planning process. First, semi-structured interviews were conducted with a representative from each of the most relevant emergency organizations in the county. Nine respondents representing 10 organizations were interviewed³: Alabama State Highway Patrol, Demopolis Post; Chemical Waste Management; Livingston Ambulance Service; Livingston Fire Department; Livingston Police Department; Sumter County Emergency Management Agency; York Ambulance Service; York Fire Department; York Police Department; and York Rush-Hill Hospital.

These interviews, which lasted 1-2 hours, addressed planning issues which are not typically ascertainable in written plans. Such issues include:

1. The nature and extent of inter-organizational coordination.
2. Inter-organizational conflicts and other problems encountered in coordination with related emergency organizations.
3. Perceived strengths and weaknesses in the planning process.
4. Perceived organizational responsibilities.
5. Perceived impediments to conducting these responsibilities.

In addition, respondents were asked to rank the probability of various types of emergency situations occurring in Sumter County. Finally, a "worst case scenario" of a chemical emergency was presented and respondents were asked to indicate how they would respond to such a situation.

At a point during the interview, after a degree of rapport had been achieved, a copy of the organization's emergency plan was re-

³Due to scheduling conflicts, representatives from the sheriff's department, the Sumter County Rescue Squad, and the Livingston-Tombigbee Hospital were not interviewed.

quested.⁴ These written plans were analyzed on the basis of a number of criteria corresponding to the principles of emergency planning discussed previously.⁵

RESULTS AND DISCUSSION

Findings are presented by first examining the context of emergency planning in Sumter County, with some general observations of overall emergency preparedness, followed by specific findings relevant to each of the five principles of emergency planning.

The Context of Emergency Preparedness in Sumter County

Virtually all of the emergency response capabilities in Sumter County are located in the two population centers of Livingston and York. The major exception is Chemical Waste Management's facility, located between Emelle and Geiger, which possesses emergency response equipment, supplies, and trained personnel capable of responding to most chemically related emergencies. In addition, several smaller communities possess a small fire truck. The town of Cuba maintains a small police department and the county is serviced by a state police post located in Demopolis, about 20 miles away in Marengo County.

Federal regulations require that companies handling hazardous wastes maintain a contingency plan which is to specify, primarily, plant procedures for responding to an on-site incident (II). The Chem Waste plan adheres closely to these federal requirements. In addition, the Federal Emergency Management Agency stipulates that counties develop an integrated community-wide plan to qualify for federal emergency funding. The organization responsible for developing and maintaining this plan is the Sumter County Emergency Management Agency. The only other organizations interviewed possessing a written plan were the two hospitals in Livingston and York. While each of these plans is stronger in some areas than others, the overall quality of existing written plans is quite good.

Overshadowing this positive feature, however, is the apparent vacuum in overall emergency planning in the county. Although Sumter County has not been confronted by a disaster of major proportion in recent years (which, in part at least, likely accounts for the relative

⁴The only plans available were those of the Emergency Management Agency, Chemical Waste Management, Rush-Hill Hospital. In addition, the Livingston-Tombigbee Hospital, which was not interviewed, made its plan available.

⁵The interview schedule and content analysis form for the written plans are available upon request.

lack in formalized planning in the county), there is clear potential for such an event. The geographic location of Sumter County leaves it vulnerable to tornadoes and to serious after-effects of hurricanes (Sumter County was a host community to hurricane victims in 1985). In addition, its proximity to the Tombigbee River and the Tennessee-Tombigbee Waterway, as well as other tributaries in the county, poses the possibility of serious flooding. The county is also vulnerable to forest fires and (to a less extent) earthquakes. Finally, the specter of a major chemical emergency is by no means remote due to the large quantity of chemical wastes converging on the county and the large amounts of concentrated chemicals passing through the county by truck and railway. While official tonnage figures were not available, a random traffic survey conducted by Chemical Waste Management in 1986 at the plant site revealed that 214 trucks entered the site over a 24-hour period (excluding 61 flue dust trucks). In short, despite recent experience and perceptions to the contrary, the potential for a major emergency to impact Sumter County indeed exists.

Predominant attitudes expressed by a number of organizational officials in the county were that "Anybody who has a plan doesn't follow it anyway," that "Everybody knows everybody," and that "We all know what to do." Indeed, the interview data support the latter belief as the data reveal that these officials are substantially more knowledgeable, particularly about chemical hazards, than their counterparts in many other communities (17). Many of these individuals have attended the fire college in Tuscaloosa (which addresses chemical fires), in addition to local area workshops sponsored by Chemical Waste Management.

The near absence of formal planning in the county, however, may pose serious problems in the event of an emergency. While there are undoubtedly a number of reasons for this deficiency, a dominant factor appears to be an over-reliance on the initiative of the Sumter County Emergency Management Agency and the expertise of Chemical Waste Management. The confidence in these agencies on the part of community officials is not misplaced; however, the existence of these organizations is no substitute for solid planning efforts on the part of every emergency relevant organization in the county.

The Process Orientation of Emergency Planning

In most respects, current emergency planning in Sumter County reflects a process orientation. All of the plans available assign re-

sponsibilities to *positions* within the specific organization. With the exception of “call-up lists,” which by their nature include names, addresses, and phone numbers of individual incumbents, all references to task responsibilities entail positional assignments. Furthermore, all of the plans have been updated within the past year, and two of the plans—the Sumter County Emergency Management Agency plan and the Chemical Waste Management plan—include specific provisions for periodic updating. The Chemical Waste Management plan specifies several conditions for updating, including failure of the plan in an emergency, revision of the facility permit, and any changes occurring in key organizational personnel, equipment inventories, or in the design or operation of the facility. The Sumter County Emergency Management Agency plan calls for an annual review.

Finally, all of the written plans are tested at least once a year in the form of “disaster drills” which involve the simulation of organizational response to one or more disaster agents. Hospital drills typically involve, in addition to the hospital, the Sumter County Emergency Management Agency and police, fire, and ambulance services from the jurisdictions in which the hospitals are located. Chemical emergencies have been included in these simulations on several occasions. Chemical Waste Management conducts an on-site drill annually and is occasionally involved in tests of the community plan. With the exception of the simulations specifically involving the hospitals, these tests usually consist of an actual response to an emergency of a minor nature, such as a fire potentially involving chemicals or a ditched petroleum truck. “Countywide” drills, which involve all of the relevant emergency organizations in the county, are less frequent, the last such test taking place May 16, 1987.

Clarity of Task Responsibilities

Examination of the written plans reveals a fairly clear understanding of the division of responsibilities among the respective organizations, although there is a great deal of variation between the plans as to the importance placed on intra-organizational features of emergency response. The Chem Waste plan places primary emphasis on assignment of responsibilities within the organization. The clarity with which roles are assigned, combined with frequent emergency drills conducted within the organization, should assure a smooth response to most emergencies occurring within the plant. The plan is less clear, however, as to responsibilities for off-site emergencies, a point which will be discussed later.

The Emergency Management Agency (EMA) plan, by contrast, is almost exclusively oriented to inter-organizational relationships, an orientation compatible with the unique coordinative role that the organization plays in an emergency. The EMA is responsible for maintaining countywide planning and for conducting multiple agency disaster drills. The EMA also coordinates the Emergency Operations Center (EOC) and the Disaster Assistance Center (DAC) during an actual emergency. These *ad hoc* centers provide a forum for various organizations in the county to assemble and organize their emergency activities. Like the Chem Waste plan, the hospital plans are primarily "intra-organizational" in focus, though not as detailed as the former. The most significant omission in the hospital plans having relevance to intra-organizational functioning is the lack of a pre-crisis inventory of supplies (or provision for such an inventory) and no provision for maintaining a continual assessment of the emergency which is required for making decisions regarding such points as the need for supplies, transfer of patients, and return to normalcy.

The interview data reveal, generally, that officials have an accurate understanding of their role in an emergency. All of the officials readily responded in accurate, though sometimes general, terms when asked to outline their primary emergency relevant responsibilities. In addition, officials were asked to rank on a scale from one to five how relevant each of 19 emergency tasks was to their organization. Again, these individuals displayed remarkable understanding of the relevance of emergency tasks, although generally there appeared to be an underestimation of the importance of some of these tasks, particularly participation in the planning process and public education. These are both tasks in which every emergency organization should be highly involved, but which have comparatively little salience in Sumter County.

When officials were asked to distinguish between natural disasters

TABLE I. PERSONNEL IN INITIAL RESPONSE AGENCIES, SUMTER COUNTY, 1986

Agency	Full time employees ¹	Active per shift
State police (3-county area)	13	2-3
Livingston police	7	1-2
York police	5	1-2
Livingston fire	5	(all on 24-hr. call)
York fire	all volunteer	(all on 24-hr. call)
York ambulance	6	2
Emergency Management Agency	1	1

¹In addition, local police and fire agencies utilize volunteer personnel whose availability varies depending on time of day, day of week, and time of year.

and chemical emergencies with regard to the relevance of these tasks, in almost all cases the tasks were considered equal in both types of situations. The major exception was Chem Waste, whose involvement in various aspects of chemically related emergencies is understandably more relevant than for natural disasters.

Finally, there were some specific problems identified by officials which have relevance to intra-organizational functioning in an emergency. Probably the most serious of these is a substantial lack of experienced personnel for responding to an emergency of major proportions, table 1.

Related to a deficiency in personnel was a lack of sufficient equipment. As one official stated, "They're not willing to pay for it (emergency preparedness) until after a disaster hits." In the case of emergency preparedness, the proverb "an ounce of prevention is worth a pound of cure" is probably a wiser maxim.

Recognition of Inter-Agency Relationships

Because of the multi-agency and multi-jurisdictional setting in which emergency response takes place, it is essential that all organizations in the community be able to coordinate their response effort. This is, however, a most problematic area in emergency preparedness and response nationwide, fraught with a number of problems including conflicts over task domains, jurisdictional disputes, problems in communication, and a lack of awareness of vertical relationships and extra-community resources. These are all problems which are exacerbated by deficiencies in the planning process and, due to the void in emergency planning, Sumter County is particularly vulnerable to difficulties in inter-organizational coordination. It was found, for example, that except for Chem Waste and EMA, most of the organizations in the study had only limited contact with other critical emergency organizations in developing and maintaining their emergency preparedness. In particular, there was a profound lack of communication on disaster planning between organizations in different political jurisdictions. Some of these inter-organizational features, however, are potentially more troublesome than others. In what follows, each of these problematic features will be highlighted as they apply to emergency preparedness in Sumter County.

Domain Conflicts

Due to the lack of systematic planning on the part of most organizations, conflict over task responsibilities is a potential scenario

throughout the emergency response effort. Nowhere is conflict more likely, however, than in the initial "on-the-scene" activities. Local, county, and state police and fire and ambulance services all have primary responsibility for initial response.⁶ Such activities require immediate action and the convergence of multiple organizations lends itself to potential conflict and confusion in the absence of any provision for an on-the-scene command post coordinator (17).

In spite of the lack of provision for initial response coordination, however, Sumter County is perhaps less prone to conflicts of this nature than might be anticipated. A major mitigating factor is the organizational structure of initial response agencies in the county. The City of Livingston has a Public Safety Department which is responsible for coordinating all activities of the municipal police, fire, and ambulance services. York, by contrast, has an independent police department, but its fire and ambulance services are coordinated from the same office. Hence, coordinated initial response is, to some degree, an extension of normal, pre-emergency relationships. Second, and quite ironically, the lack of personnel noted above may actually serve to reduce potential inter-organizational conflict, particularly in a major emergency requiring large numbers of personnel. Individual organizations simply do not have the luxury of "claiming" various tasks as their sole responsibility. In addition, the local police and fire departments, ambulance services, and the rescue squad all utilize a sizable volunteer staff, many of whom participate in more than one organization. While this may pose certain problems for individual volunteers regarding which "hat" to wear, such a situation does maximize the effectiveness of the limited number of response personnel. Finally, in the case of chemical emergencies, local officials recognize their limited expertise and resources and almost universally indicate a willingness (even preference) to accede to the initiative of Chemical Waste Management in conducting their respective on-the-scene activities.

This reliance on Chem Waste, however, is not without its own disadvantages. The waste disposal facility is located in the northern part of the county, over 20 miles away from the southernmost portion. Many initial response activities, particularly the neutralizing of hazardous materials, require immediate action. Over reliance on company personnel and equipment to accomplish these tasks may unne-

⁶The sheriff was not available for interview. However, it is generally understood that he shares in initial on-site responsibilities. This is consistent with other communities in the United States.

cessarily endanger the health and safety of emergency personnel and citizens in the area. At the same time, of course, when Chem Waste resources are responding to an emergency in the community, emergency response capabilities at the plant site are proportionately reduced, a situation which could create serious problems in a major disaster. This does not suggest that Chemical Waste Management should not be ready and able to respond to a community emergency; indeed, this firm would be remiss in its community responsibility as a corporate neighbor if it were not. However, this suggests that greater commitment on the part of county and local governments to emergency preparedness and response in the way of increased personnel, training, and equipment is needed to mitigate potentially serious problems in a major emergency.

Jurisdictional Problems

Sumter County has a comprehensive mutual aid agreement among various jurisdictions within the county as well as with neighboring counties. All officials interviewed were familiar with the agreement and clearly articulated with a great deal of consensus the jurisdictional authority for various tasks. Less clear, however, was the locus of authority for emergencies occurring at the waste site which threaten the surrounding community. The facility's plan stipulates that appropriate company officials will make a determination as to whether community officials need to be contacted. There is, however, a fundamental conflict of interest inherent in such a situation. The waste facility itself has become so politicized that it is difficult to conceive that the facility will be anxious to report such incidents to local authorities. The decision to notify may thus be delayed, thereby inhibiting local warning and evacuation efforts. It would thus seem advisable that the authority to notify the community of an on-site emergency falls within the jurisdiction of the Alabama Department of Environmental Management, which has an office located at the site.

Communication Problems

While intra-organizational communication procedures are clearly articulated in the written plans, there is less provision for communication between organizations. This is especially problematic during the initial response phase, characterized by a lack of a clear-cut definition of the situation (17). Call up lists are included in the plans with names and phone numbers of emergency officials, and the EMA plan includes a separate section on communications. There is, how-

ever, little information regarding what organizations and/or individuals to contact for specific tasks.

Perhaps the greater immediate problem, however, is of a technical nature. In particular, a number of officials mentioned a lack of hand-held radios or "walkie-talkies." Because of this, response officials lose either mobility or communication capability, since their only radios are located in vehicles. This normally is merely inconvenient, but, during a major incident, it may result in loss of vital information.

Vertical Relationships

A number of extra-community organizations constitute the total emergency response system for a major emergency in the county. The EMA is part of a state and federal emergency management system (AEMA and FEMA) and the EMA plan reflects this relationship. The plan is developed according to FEMA guidelines and there is provision for reporting all major emergencies to the Alabama Emergency Management Agency. Chem Waste has national offices in Oak Brook, Illinois, to which it must report all releases of hazardous substances. In addition, the parent company maintains a regional Environmental Remedial Action Division (ENRAC), currently located in Memphis, Tennessee, which can be readily mobilized to respond to a major spill. Surprisingly, however, there is no provision for activating ENRAC in either the CWM or the EMA plan. Also, the company is closely regulated by the Environmental Protection Agency and the Alabama Department of Environmental Management. The Chem Waste plan adheres closely to EPA and ADEM specifications for contingency planning.

In addition to the organizations already mentioned, there are a number of extra-community resources available. All officials interviewed were clearly familiar with CHEMTREC, a toll free information center providing vital technical information necessary for appropriate response to a chemical emergency. The unanimous awareness of CHEMTREC is indeed impressive. Recent research by Quarantelli revealed that this level of awareness is not generally found in communities subject to potential chemical hazards (17). There was no awareness, however, of the Community Awareness and Emergency Response (CAER) program implemented in 1985 by the Chemical Manufacturers Association (CMA) to aid in the development and integration of local chemical emergency plans. In addition, the Alabama Highway Patrol maintains a HAZMAT team in Montgomery trained to handle emergencies involving hazardous materials. This is a valuable resource which was not widely acknowledged by

local officials. This lack of awareness is possibly due to an apparent marginal role of the state police as perceived by local officials.

Finally, several area organizations are available for medical aid. The York hospital is a subsidiary of a corporation whose parent hospital is located in Meridian, Mississippi, about 40 miles away. While interhospital relationships are not acknowledged in the local hospital plan, arrangements exist for the transfer of patients between hospitals when necessary. In addition, the county is serviced by several medical helicopter service agencies. None of these services, however, is acknowledged in either of the hospital plans and only one—Helivac in Tuscaloosa—is mentioned in the EMA and Chem Waste plans.

Cognizance of the Public

Ultimately, of course, the purpose of emergency planning is to preserve life and property. With the exception of the Chem Waste plan, all plans obtained contain moderate to extensive provisions for communicating vital information to the public. Officials interviewed, however, indicated that the most crucial items of information to be communicated—warning messages—are also the most difficult. The primary warning devices are sirens located in Livingston and York. Many rural residents, however, are out of range of the sirens and must be notified by telephone, mobile sirens, and even door-to-door contact. All of these warning strategies are time consuming—possibly too much so to be effective. While there is no perfect warning system in any community, installation of a siren system at the hazardous waste facility would provide some means of warning local residents of an emergency situation.

Related to warning, evacuation of residents is a critical task in any major emergency. Importantly, while evacuation planning should be a high priority in emergency preparedness, it is erroneous to “over-plan.” That is, it is impossible to plan for every possible evacuation route and to specify every condition under which evacuation should take place. There are simply too many variables and options to plan with this kind of specificity. A change in wind direction, for example, may entirely alter an evacuation route. Particularly where natural hazards are involved, certain possible routes may be blocked. Rather, evacuation planning should specify (1) *general* routes from an area, and (2) *principles* which can be readily communicated to the public. In the case of chemical emergencies and tornadoes, for example, the principle of evacuating at right angles to wind direction most quickly

moves one out of the path of the threat. Such information should be widely disseminated to the public.

Officials in the community correctly perceive that motivating residents to leave a threatened area is a major problem. Contrary to popular belief, communities threatened by disaster do not typically panic; the greater problem is convincing residents that the threat is serious enough to vacate their homes. This problem does not appear to be adequately addressed in the written plans evaluated. The EMA plan, for example, devotes an entire section to evacuation. Nevertheless, the plan assumes that "the public will both receive and understand official information related to evacuation," and that "the public will act in its own interest and evacuate dangerous areas when advised to do so by local government authorities." Research on community response to disaster has revealed that citizens are, in fact, hesitant to evacuate even when threat to life and property is clear (10,18). Assuming a willing public, as the EMA plan does, seems certain to court problems by failing to provide strategies for motivating the public to evacuate.

Another typical public response correctly identified by plans and officials is the tendency for people to converge on the emergency site, as well as at other critical locations, such as hospitals and emergency shelters. This problem is recognized in Sumter County planning. The EMA plan, for example, details involvement from all agencies expected to manage convergence. In addition, the plan has established a pass system to control convergence of unofficial traffic. Officials interviewed also recognized convergence as a major problem and are prepared to respond in appropriate ways.

Whereas convergence resulting from heightened public interest poses certain problems during the immediate post-impact period, quite the opposite problem characterizes the pre-emergency period; this is public apathy and general community resistance, a problem observed nationwide by Quarantelli (17). Emergency officials have difficulty in eliciting public support in the way of funds, planning input, and participation in educational and planning workshops. The Emergency Medical Service (EMS), for example, is a community educational and planning group whose membership is to consist of one "provider" (emergency service organization representative) for every "consumer" (citizen). The problem, it seems, is finding enough consumers to serve. While officials often interpret the lack of public involvement as due to apathy, it is often the case that the public simply does not know how to effectively participate in these community processes. Again, this is not a situation unique to Sumter County. Min-

imally, continuous public awareness programs, some of which are currently being pursued (e.g., public school presentations), should be implemented. Such programs, if done effectively, serve the dual purpose of informing the public as to how to respond to an emergency and educating the public on how to become involved in community emergency preparedness.

Comprehensiveness of Emergency Preparedness

Disaster Agents Anticipated

Sumter County is vulnerable to a number of disaster agents, including chemical mishaps, tornadoes, hurricanes, forest fires, floods, and to a lesser extent earthquakes and human-precipitated emergencies, such as massive auto accidents and plane crashes. The only written plan which formally addresses the breadth of scenarios potentially affecting the county is the EMA plan. The Chem Waste plan appropriately addresses primarily chemical related emergencies, although it does recognize the implications that various natural disasters may have for secondary chemical emergencies. Both hospital plans are generically written with no specific focus on particular types of disaster agents.

In addition, respondents were asked to rank on a Likert-type scale the probability of 26 different types of emergency scenarios impacting the county within the next 10 years. Generally, officials were optimistic, possibly underestimating the likelihood of being victimized by a major emergency, table 2. These data are expressed as average responses regarding the likelihood of certain kinds of emergencies.

TABLE 2. OFFICIAL PERCEPTIONS OF THE PROBABILITY OF SELECTED EMERGENCY EVENTS

Emergency event	Average ranking ¹
Massive auto accident	3.9
Tornado	3.8
Chemical leak/truck accident	3.0
Hurricane	2.6
Forest fire	2.6
Plane crash	2.5
Sudden toxic chemical release	2.1
Contamination of streams/rivers	2.1
Aquifer contamination	1.9
Flood	1.8
Flash flood	1.5
Chemical plant explosion	1.4
Earthquake6

¹0 = not applicable to community; 5 = almost certain in 10 years.

All of these are potential scenarios in Sumter County; however, only three—massive auto accident, tornado, and major chemical leaks from a truck accident—are ranked at the 3.0 median or above. It is difficult, of course, to accurately predict how likely these scenarios are to occur. However, their low perceived probability has relevance for the salience of emergency planning as an important community priority and may account in part for the low level of formal planning found in the county.

Temporal Comprehensiveness of Emergency Planning

Emergency planning is most effective when it addresses the four broad emergency relevant phases delineated by the Federal Emergency Management Agency—mitigation, preparation, response, and recovery. The importance of this comprehensive approach to emergency preparedness is formally recognized by the FEMA requirement that local communities develop emergency plans addressing these temporal phases comprised in the Integrated Emergency Management System if they are to receive federal funds. In response to this requirement, the EMA plan has highly integrated each of these temporal phases into its community plan. The other plans focus almost exclusively on response, although the Chem Waste plan does marginally address mitigation, preparation, and recovery.

Because the interviews primarily addressed issues related to preparation and response, it is difficult to assess the overall level of planning for mitigation and recovery, except to say that Chem Waste is required by EPA and ADEM regulations to (1) maintain ongoing monitoring of incoming waste streams and test wells, which is itself a mitigation activity; and (2) to maintain liability insurance coverage for both chronic and acute accidents (or “events”) to facilitate community recovery from an accident. Minimum liability insurance required by EPA and ADEM in 1987 is as follows:

Chronic events, such as groundwater and aquifer contamination and occasional atmospheric releases	\$2 million per event \$6 million per year
Acute events, such as major spills and plant explosions	\$1 million per event \$3 million per year

Beyond this, however, most officials interviewed were unable to clearly specify who was responsible for enforcing transportation reg-

ulations and for providing long-term financial assistance to victims of a major emergency. While these mitigation and recovery responsibilities are not the domain of any of the organizations interviewed and are marginal to what is usually regarded as emergency response, the lack of clarity on these domains does suggest the need for a more integrated, community-wide emergency planning effort.

SUMMARY AND CONCLUSIONS

The case study reported herein considered emergency preparedness in Sumter County in the context of general planning principles derived largely from the study of natural disasters. Chemical emergencies are also recognized to pose unique problems not shared with natural disasters. The nature of the threat, for example, is not always clear. Similarly, damages may not be immediately apparent, rendering it difficult to engage in effective response activities. Moreover, hazardous wastes pose special problems in response because several chemicals are often involved, which complicates effective response due to the unpredictable interactive nature of some chemical mixes.

Despite the special circumstances, there are a number of common planning problems with natural hazards which benefit from a general analysis such as that from this study. By way of summary, it might be helpful to highlight the strengths and weaknesses observed in emergency preparedness in Sumter County. While these observations are admittedly those of "outsiders," this very distance might be constructive in improving emergency planning, not only for Sumter County but for those communities hosting hazardous waste sites throughout Alabama and the United States. Four specific needs were identified.

1. *Establish Comprehensive Plans.* A profound paucity of planning in Sumter County was observed. This deficiency is most obviously manifest in the fact that few organizations had any written plans. Beyond this, however, most officials quite candidly admitted that Sumter County is not adequately prepared to respond to a major chemical emergency should one occur. It is strongly suggested that the emergency response system in Sumter County engage in a concerted planning effort, coordinated through the Emergency Management Agency. The product of this planning effort should be a written plan on the part of *every* emergency organization specifying agency responsibilities. This plan should be reviewed on an annual basis.

There are four basic reasons why emergency plans must be written. First, contrary to the common assumption that "we all know

what to do," chemical disasters pose unique problems which cannot be anticipated on the basis of non-chemical emergency experience (17). Second, the written plan provides a basis for predictable response in an actual emergency situation. Formal designation of organizational responsibilities greatly reduces the likelihood that important emergency relevant tasks will be overlooked, or that other tasks may be unnecessarily duplicated. Third, the written plan allows for a more efficient evaluation of organizational preparedness for disaster. The purpose of disaster drills, for example, beyond merely providing a "practice run," is to evaluate the preparedness of local organizations. Without a written plan, there are no criteria to rigorously assess how well the organization has performed. Finally, the value of a written plan is perhaps most salient in the face of personnel turnover in emergency relevant organizations. Often, incoming personnel have had no emergency related experience, and if they have, they may not be familiar with local agreements, expectations, and other related situations.

Inter-organizational relationships were remarkably good in the county, even across political jurisdictions. Also noteworthy was the positive relationship between public organizations and Chemical Waste Management. The lack of a formalized planning process, however, places these relationships in jeopardy, or at least renders them less efficient and potentially ineffective in an actual emergency. Beyond the mutual aid agreement, sustained inter-organizational planning efforts such as those suggested previously should facilitate inter-organizational preparedness.

While formalized emergency planning that exists in the county has a distinct process orientation, this quality could be improved in two important ways. First, only a limited number of organizations are actively involved in the formal planning process. Most organizations in the county do not even have a formal plan to be updated and tested. Moreover, there is little in the way of active input into the EMA and Chem Waste plans on the part of local organizations. Such input would be greatly facilitated through the use of regularly scheduled planning workshops, a second suggested improvement. While the Emergency Medical Service (EMS) meets on a periodic basis, this coalition of organizations involves only medical related organizations.

The full spectrum of emergency organizations should be involved in ongoing planning activities. Planning workshops have a number of advantages. First, they encourage a more active role on the part of all organizations in the planning process. Second, they serve as a valuable training function for new incumbents in key emergency positions

in the community. Third, the exchange of ideas in a forum such as this can be valuable in locating weaknesses in planning which can be addressed in future updating and testing. Finally, these workshops provide an opportunity for officials in various organizations to become familiar with the responsibilities and problems encountered by other emergency agencies in the county.

2. *Increase Available Emergency Personnel and Equipment.* Organizational officials were quite knowledgeable of their respective domain responsibilities and had a basic knowledge of what is required in fulfilling these responsibilities. The greater problem was a lack of sufficient personnel and equipment to respond adequately. The communities of York and Livingston have responded most creatively by coordinating their fire and ambulance services and (in the case of Livingston) police departments under a single umbrella organization. Such a strategy makes the most efficient use of existing personnel.

Nevertheless, provision for greater resources in the way of equipment, personnel, and training of personnel is required if the county is to be prepared to respond to the demands of the kinds of emergencies which potentially threaten the county.

3. *Increase Public Awareness and Involvement in Emergency Planning.* One of the greatest obstacles to effective emergency preparedness is the lack of effective public involvement. Organizational officials are aware of this. Understandably, because of the highly politicized nature of potential chemical emergencies in Sumter County, officials are quite ambivalent about the lack of public involvement. While they recognize the need for public awareness of the issues, such awareness often promotes conflict and criticism. Nevertheless, because successful community response is contingent upon the public knowing what to do and being willing to act on this knowledge, emergency preparedness should maintain a high profile in the community. Promoting educational programs in the schools and initiating informational hearings and periodic media presentations can be effective in this regard. In addition, publicizing disaster drills and encouraging the public to observe and (where appropriate) participate in these drills can be highly effective both as an educational tool and in soliciting valuable public input and participation in the planning process.

4. *Broaden Scope of Emergency Preparedness to Incorporate Plans for Mitigation and Recovery.* Planning is less than comprehen-

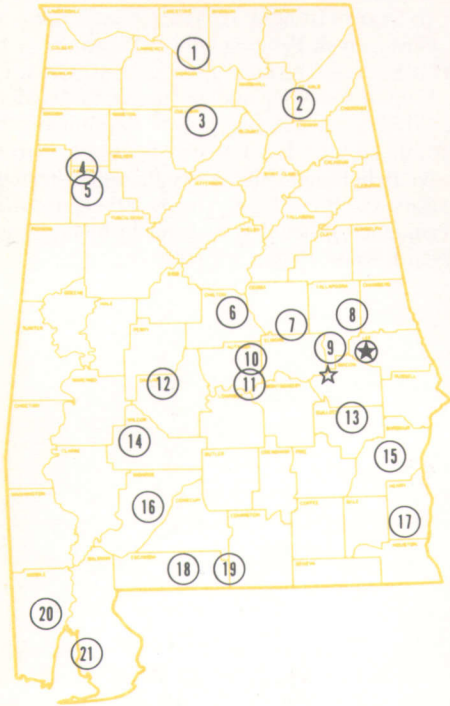
sive in Sumter County, not so much with regard to types of disaster agents as to temporal phases involved in emergencies. In particular, mitigation and recovery are not a salient part of emergency preparedness. This is understandable given the historical bifurcation of mitigation and recovery on the one hand and preparation and response on the other. Traditionally, the emergency response system has defined its role as preparation and response, while mitigation and recovery have been defined as the domains of such groups as urban planners, departments of health and public service, and federal loan agencies. However, as FEMA and others have recognized (7,13,19), mitigation and recovery are an integral part of emergency preparedness. Organizations such as urban planning boards and public welfare services, which have traditionally played only a marginal role in the emergency planning process, are encouraged to be more fully integrated into the emergency response system.

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Alabama's Agricultural Experiment Station System

AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

- ★ Main Agricultural Experiment Station, Auburn.
- ☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Chilton Area Horticulture Substation, Clanton.
7. Forestry Unit, Coosa County.
8. Piedmont Substation, Camp Hill.
9. Plant Breeding Unit, Tallassee.
10. Forestry Unit, Autauga County.
11. Prattville Experiment Field, Prattville.
12. Black Belt Substation, Marion Junction.
13. The Turnipseed-Ikenberry Place, Union Springs.
14. Lower Coastal Plain Substation, Camden.
15. Forestry Unit, Barbour County.
16. Monroeville Experiment Field, Monroeville.
17. Wiregrass Substation, Headland.
18. Brewton Experiment Field, Brewton.
19. Solon Dixon Forestry Education Center, Covington and Escambia counties.
20. Ornamental Horticulture Substation, Spring Hill.
21. Gulf Coast Substation, Fairhope.