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OUTLINE OF A MODEL FOR STUDYING COMMUNITY PREPAREDNESS FOR ACUTE CHEMICAL DISASTERS*

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This short working paper is divided into four parts. In the first part, we provide a brief general background of our study. In part two, some specific information about the research design used and the data obtained in the first year of the work is given. In the third part, we present in schematic form the overall model being used to analyze our data on community preparedness for acute disasters resulting from chemical agents. The fourth and last part of the paper focuses on the basic unit of analysis in our model; that is, on the "local community" and indicates some of the kinds of questions which are being addressed in the study. However, this paper uses the systematic data we have obtained only for illustrative purposes since a detailed presentation of research findings will be published at a later date. Our major intent here is to present the model we are using and to show some of the issues involved. Thus, this paper represents one way of looking at the problem of community preparedness for acute chemical disasters and what we consider important in any description and analysis of the problem.

General Background of the Study

In the last 20 years, considerable research has been done on how people behave and how groups react to natural disasters such as tornadoes, floods, hurricanes and earthquakes. These studies by social scientists have led to improved disaster planning and better recovery from such mass emergencies. Research is now being started on another general class of disasters, those brought about by technological failures or accidents. As in the case of natural disasters, studies have been initiated into sudden technological disasters so improvements can be made in preparations for and responses to this kind of threat and danger.

In line with this new interest in technological disasters, DRC obtained a grant from MSF to undertake a three-year study of disasters resulting from chemical agents. The focus of our research is on community preparations for responses to and recovery from relatively sudden chemical disasters. A number of field studies will be undertaken and will include extensive interviewing in police and fire departments, civil defense offices, hospitals, relief agencies, mass media units, organizations involved in producing, transporting, storing and using dangerous chemical substances, and in all other communityrelevant groups that would be involved with sudden mass emergencies.

There are three phases to the study. During the first year of work, which has just ended, community preparations for disesters involving chemical agents have been the object of our research. We studied a total of 19 communities around the United States, exhibiting varying degrees of potential for sudden chemical disasters. The model which is the major focus of discussion in this paper is being currently used to analyze the body of data gathered in those communities.

The second phase of the study, beginning in 1979, will concentrate on the emergency time period of actual incidents involving chemical hazards. DRC will make an effort to study a sampling of all such major events in the United States over a 15 month period. This research will involve on-the-scene observations and in-depth field interviews with public safety, governmental, industrial and community groups and agencies involved in responding to a sudden chemical disaster. Two to three dozen field studies are anticipated. Catastrophic incidents outside the United States may also be studied, especially if they are of the magnitude of the dioxin cloud release in Sevesa, Italy.

The third phase of the DRC research will examine the longer term consequences of, rather than the emergency time response to, sudden chemical disaster. We will make an effort to trace the effects of recovery from such a disaster on community preparedness for mass emergencies over a period of time. This will necessitate periodic revisitation of DRC to some selected localities which have already undergone major disasters.

During the first year of the study, field work focused on community preparedness for sudden disasters, including those involving toxic releases, explosions or other chemical agent emergencies. Our research objectives necessitated picking a sample of communities, deciding on what organizations and personnel within them to contact, determining the nature of the information required by our research objectives, and designing the field instruments. In addition, we had to plan for and, in fact, did undertake some field studies of actual disaster events involving chemical agents.¹

Many factors were considered in selecting the 19 communities finally chosen for study. In order to achieve some variation in our sample selection, the following criteria were used: size of community; region of the country; concentration of chemical companies; transportation facilities, previous disaster experiences, ownership pattern of local manufacturers; and types of chemical products. In addition, we needed samples which would reflect different state regulations and enforcement practices with respect to the production, distribution, transportation and storage of hazardous chemicals. Thus, we selected three communities in each of three states which had different sets of regulations and practices. In the event that everything else was roughly equal, we chose communities in which the Center had done some prior field work, since that allowed us to draw on previously gathered community and organizational data with respect to disaster preparedness.²

Within each community, six organizations were usually examined so that a picture of the overall disaster preparedness in the locality could be obtained. Those chosen were the office of civil defense, the police department, the local Red Cross chapter, the local EPA office, the major general hospital in the area, and in localities with harbors or waterways, the Coast Guard or the port authority. Other organizations contacted, more for their own rather than overall disaster preparedness, were the city and county fire department, the sheriff's office, the public health department, the office of mayor or city manager, the local state police post, utility companies, the National Weather Service station, labor unions, mutual aid organizations and the office in charge of railroad yards in the locality. Finally, a sample of facilities which process, manufacture, use or transport large amounts of hazardous chemical materials was taken with the choice of particular companies being made on the basis of the specific information and knowledge obtained by the DRC field team studying the community. In all organizations contacted, the key officials who were knowledgeable, responsible or defined as primarily concerned with disaster preparedness were normally interviewed.

Three different interview guides were used depending on the organization being studied. In general, most officials were asked to fill out a disaster probability scale for their area, i.e., to make an assessment on a 0 to 5 scale of the probability of their locality being hit by one of 36 different kinds of possible natural and technological disaster agents. The interview guides themselves tapped the major dimensions of our theoretical model, namely, such matters as threat demands, resource capabilities, social climate, social linkages, disaster planning and feedback processes. Generally, we wanted to know who had responsibilities for what disaster tasks, what were the relationships and the cooperative and conflicting interactions of various emergency related community groups with one another, and what was the specific disaster planning of each organization contacted. The intra and interorganizational safety and disaster planning of chemical plants was a particular point of focus. In addition, in each area studied, we collected documentary and statistical data relevant to understanding the community and factors which might affect its disaster preparedness.

Contact was made with about 400 organizations which resulted in our obtaining over 300 disaster probability scales, several hundred in-depth interviews, and quantities of documents such as agency disaster plans plus socio-economic statistical data from each of the communities. This material is being subject to extensive quantitative and qualitative analyses. The final product has or will be a theoretical monograph for disaster planners, a manual for operational personnel, a set of case studies for community officials, and a series of articles written for different audiences ranging from social science researchers to administrators and policy makers in organizations involved in some way with hazardous chemicals.

The Overall Model

In graphic terms, the model we are using is presented below. It depicts the key dimensions we are using in our descriptive and analytical efforts. Conceptually, these dimensions include the notion of local community, threat, resources, linkages, social climate, planning, feedback and the extracommunity setting. Resources, social linkages and social climate are respectively depicted as being within the context of one another. This is an effort to indicate the more abstract nature of the phenomenon as one goes from resources to social linkages to social climate.

EXTRACOMMUNITY SETTING



Our working model assumes that for any given community there is the possibility of some kind of danger (by chemical and other threat agents). These threats can be seen as representing the input or demands on the community for disaster preparedness. However, within any given community, there are always some capabilities for meeting such demands. These can be thought of as the material resources which can be brought to bear to meet the demands. The resulting balance between threats, i.e., demands and resources, i.e.+, capabilities is reflected in some mode of social organization at the community level, i.e., a particular pattern or set of links among the organized elements involved in preparing for local disasters. The specific form that the social linkages take is a matter of empirical determination. It may, for example, take the form of a system, a network, a cluster or a fragmented set of social units prepared in varying degrees to respond to a disaster. In turn, different social, political, economic, legal, historical, or psychological conditions affect the social linkages and resources which are likely to be present in any given community. Such conditions can be thought of as the social environment or climate. Whatever the particular constellation of elements in any given community, one outcome or output is some kind of disaster planning. The planning may include meetings, rehersals, drills, memo of understanding as well as written plans themselves. In turn, the planning may feedback affecting not only demand threat possibilities, but also the resource capability, the social organizational pattern or the social linkages and the social climate context.

Of course, no community exists in a social vacuum. Thus, the <u>extracommunity setting</u> also has to be taken into account. This setting represents all the socio-cultural factors outside the community which affect disaster preparedness within it. The factors may range, for example, from legal norms at the federal level to the power of national headquarters of chemical corporations to affect the safety operations of their local plants.

The Local Community

A full description and analysis of community preparedness for acute chemical disasters would involve using all eight major dimensions of our model. However, for the illustrative purposes of this paper, we discuss only the notion of local community.

Preparations for serious accidents involving the sudden release of hazardous chemical substances could be described and analyzed at different social levels. We could look at the problem from a societal viewpoint focusing perhaps on the relevant federal organizations, national transportation systems and corporations with multiple facilities scattered around the country. For example, examination could be made of what immediate response capabilities are available on the national level among the regulatory agencies, transporters and the producers of hazardous chemicals. Or our focus could be at the state level, examining and comparing how the problem is handled within and between these intermediate level social entities. For instance, we could study the results of different enforcement practices regarding varying regulations among states with regard to the production, distribution and use of dangerous chemicals. However, we have chosen instead to focus primarily at the local community level and secondarily on those organizations within the communities which are somehow involved with the problem. This means looking at the public safety and emergency relevant organizations of a community, as well as those private groups concerned with the production, transportation and storage of hazardous chemical materials.

The focus on the local community level is not a purely arbitrary choice. Higher level social entities are very important in understanding the problem, and we do treat them as a significant extracommunity factor in the local situation. But sudden disasters emanating from chemical agents occur almost exclusively in particular geographical locations at specific points in time. They very, very seldom impact simultaneously over a wide area as do hurricanes and floods and as can tornadoes and earthquakes. Furthermore, the initial responders to such kinds of crises necessarily have to be relevant organizations in the nearest local communities. It is what the very first responders do by way of identifying and attempting to deal with the threat which frequently determines if the happening will be merely a minor mishap or escalate into a major disaster. Thus, however important supracommunity factors may be, preparedness at the local level is always crucial. Given this, it does seem appropriate, at least in an initial approach to the problem, to use the local community as the basic unit with which to describe and analyze preparedness for chemically based disasters.

There are, of course, different ways of conceptualizing a community. The sociological literature alone provides dozens of definitions of community which can be useful for varying objectives by the users of the term. For our purposes, we can think of a community as an aggregation of people living together within a particular geographic area who carry out certain relatively self-contained functions relevant to the maintenance and survival of that population. Looked at in a slightly different way, a community is a locality-based social system which acts in a collective fashion to solve certain everyday problems. Typically, the core of any such operative community in the Western world is some relatively dense concentration of people, although this core can range from a small village to a very large metropolis.

It should be clear from this that an operative community cannot be totally equated with the formal boundaries of standard governmental entities, be they a country, a city, a township or some other incorporated legal unit. The very concept of community tries to indicate that what goes on within the formal boundaries of legal entities often does not adequately capture the ways in which people and groups are often collectively organized to handle their problems. Thus, for example, community preparations for handling chemicallybased disasters cannot be understood by looking just at the situation in the largest formal governmental entity in the area, say a city. Other governmental entities in and around that city, which may be other cities, towns, villages or incorporated localities, are usually part of the community in that area, and their preparedness status has to be understood as well for an accurate comprehension of the situation to be reached.

The descriptive and analytical importance of this goes beyond the point that multiple governmental entities may be part of the operative community in the area. There is the question of who has prime responsibility for disaster preparedness. Which organization, if any, plays the lead role?

There is also the related fact that there are different bases of organizational authority within U.S. communities with complicated relationships between the public and private sectors. For example, there are community agencies which are exclusively public in nature such as municipal police departments. But then there are also quasipublic groups such as most utility companies and other social entities such as railway companies which, while privately owned, are subject along some lines to detailed public regulations. Finally, there are the private organizations. Different communities have varying combinations of these four kinds of organizations within them and who has influence, power and authority over whom may be a very intricate matter. As an illustration, the phenomena of the so-called "company town" may be noted where public authority is often secondary to private influence and power.

Another complicating factor is that, given its unofficial existence, it may be unclear if certain geographic areas are or are not part of the community's concern or which organizations, if any, have responsibilities over particular nearby areas. Especially outside the boundaries of cities (and sometimes even within them), it is not always clear, legally or otherwise, who if anyone has prime responsibility for different kinds of community-relevant activities. In rural areas, for example, where many transportation accidents occur, responsibility for different kinds of emergencies may be a compound of not always consistent legal statues, informal interorganizational understandings and traditional ways of doing things based on longforgotten historical happenstances. In an earlier DRC study which focused on the delivery of emergency medical services, it was not infrequently found that those ambulance services and hospitals which were involved in the delivery of such services, resulted from a mixture of the just noted possibilities.

The final complicating factor we might note is that the relationship of supracommunity organizations to the local community can be both complex and indirect. While in the United States, there is a formal governmental hierarchy from federal to state to some kind of local incorporated entity, there is no automatic and direct imposition of ... authority from the top down. Lower level governmental units have different degrees of autonomy protected by law as well as a widespread political wariness of intervention from the top. On the other hand, higher level organizations have a variety of devices at their disposal ranging from publicity and recommendations to mandatory program requirements and laws which can be used in both direct and indirect ways to push and implement changes. For example, the U.S. government does not through federal law directly impose land use restrictions on flood plains, but does indirectly try to affect preparedness by making the possibility of obtaining various kinds of federal funds contingent on the acceptance of flood insurance and other measures which can be initiated by local level entities.

Thus, by using the community level as our prime focus in our research, we are faced, in each particular case, with having to answer at least four basic questions:

- 1. What are the community organizations which have responsibility for preparing for sudden chemically-based disasters or, more specifically, which formal group of the many operating in the community is salient in taking the lead for such disaster preparedness?
- 2. What is the basis for the assumption of responsibility for the preparedness attempted or, more specifically which sector, public or private, prepares for acute chemical disasters?
- 3. What is the geographic scope of the responsibility assumed, or even more specifically, are all parts of the operative community equally covered in chemical disaster planning?
- 4. What is the relationship of supracommunity organizations to the local community, or more specifically, are some aspects of preparedness for disasters resulting from chemical agents seen as other than local organizational responsibility?

These four questions essentially stem from the fact that the of erative local community is not the exact equivalent of whatever is within the boundaries of some formal governmental entity. Thus, in order to understand preparedness for sudden chemical disasters, it is recessary to know the salient disaster-relevant organizations in the operative community, the basis of disaster preparedness responsibility essumed by organizations within that community, the geographic area over which responsibility is taken, and the relationship of supracommunity organizations to the local entity. This does not cover all aspects of the community dimension in preparing for chemical disasters, but it does capture some of the matters we consider important.

The usefulness of our approach can perhaps be illustrated in two ways. We will give examples of what we found in our data when the questions just indicated were asked. We also suggest a difference in the answers obtained when a contrast is made between community preparedness for natural disasters as compared with those for chemicallybased disasters.

Thus, in most American communities, research by DRC and others have shown that preparedness for natural disasters is generally the major responsibility of one organization, usually the civil defense agency in the largest governmental entity in the geographic area. Such responsibility does not mean that the agency is the only one involved in disaster preparedness or even that it is the most operationally important. Rather, it is that whatever the organization, it is the lead one in calling attention to the range of natural hazards in the area; in helping to coordinate the activities of other groups involved in planning for the problem; and in providing disaster-relevant resources such as warning systems, an EOC, specialized equipment and information on how to prepare for natural disasters. Furthermore, the key lead organization and other community emergency groups accept that natural disaster preparedness and response is a local community responsibility, even though the overall planning might indicate the involvement of some extracommunity elements for certain specific problems. Thus, in most localities there is usually one key local governmental organization which has the prime responsibility for thinking about and preparing for disasters from natural hazards anywhere in the operative community.

With regard to overall preparedness for technological disasters generally, which includes sudden chemical disasters, there seldom is one organization which assumes the responsibility. Most civil defense agencies are only peripherally involved in preparations for disasters resulting from chemical dangers. Many municipal fire departments do have an interest in such kinds of hazards, but they very seldom serve as lead groups among other emergency operations: furthermore, fire departments almost always operate only within well defined jurisdictional boundaries and cannot have a specific mission in the operative community as such. Some local chemical plants often reflecting corporate policy may undertake major disaster safety preparedness activities, but such a concern very rarely is expressed in any assumption of a lead role in the operative community generally. Thus, there typically is no one organization with major responsibility for overall preparedness for disasters from chemical agents in most communities.

Given that, it is not surprising that it is rare to find any local organization involved in an overall chemical risk assessment of the community. In parts of the private sector, such as among chemical plants, there may be vulnerability analyses in terms of their own internal operations, but this interest is not extended to the entire community. Similarly, such transporters as railroads may be aware of hazards from their own functioning, although even this information is often reluctantly if at all shared with other community groups. Some local governmental environmental agencies do at times acquire some understanding about the kinds and range of chemical risks in their localities, but such knowledge is not systematically acquired. We also found that even among community emergency organizations awareness of hezardous chemicals manufactured or processed in the area tended to be very low. Thus, in the overwhelming majority of American communities there is neither one organization or a collection of organizations which could or can provide a good and complete chemical risk assessment of the area.

Furthermore, little effort normally is given by any local organization to coordinating whichever community groups do have fragmented interests in the problem of dangerous chemicals. For example, it is widely recognized that evacuation is a central question to be addressed in preparing for disasters from chemical substances. But our study showed few attempts at the local level to organize and integrate the multiple groups which would necessarily be involved in such an activity. Greater attempts at planned coordination of all kinds, however, can be seen where industrial mutual aid systems exist. But such systems are not found everywhere, including communities with fairly obvious potential risks. In most localities, there simply are not lead organizations attempting to coordinate the activities of those groups concerned in some way with preparing for chemical disasters.

Given the usual lack of coordination, it almost follows, as our study did show, that often there will be problems at the community level with respect to both awareness of and preparations for mobilization of resources needed for such disasters. Thus, while some local fire departments sometimes do have an awareness of the resources needed to deal with chemically based disasters, most other emergency organizations have little knowledge of any kind about the problem, and there is little centralization of information about possible relevant resources. In fact, in planning efforts it is generally overlooked that in all probability police department rather than fire department personnel will be first on the scene of at least transporationrelated chemical disasters. Yet police organizations have much less knowledge of the resources needed than do fire agencies. Actually, very few locally based groups have the specialized personnel, relevant information or special equipment required for fighting chemical hazards, or even the knowledge of where such resources could be located and obtained. Except for some chemical plants, there seldom is a local source which can even provide information about relevant resources.

Part of the reason for this ignorance of resources probably stems from the pervasive division of American life into public and private sectors. Among other things, this leads to an additional mutual ignorance of what the organizations in the other sector have planned and could do. Local fire departments are usually the major and often the only point of contact between local emergency organizations and chemical companies in an area. Because of the narrowness of this linkage between the two sectors insofar as disaster preparedness is concerned, knowledge of general community disaster planning is scanty among local chemical companies. Similarly, DRC has found most public safety agencies know little about what the companies are prepared to do in a major emergency.

But preparedness in part also depends on how a chemical threat is defined and here, too, the public and private sectors differ. The chemical plants, all private, tend to define potential threats from chemical agents in terms of their possible impact on company property and workers (at the corporate level of course, they can be concerned with threats to the public from transportation accidents). Mass emergency agencies, primarily public, instead define such threats in terms of possible impact on the population at large and the general functioning of the operative community. Thus, we find the public and private sectors tend to use different criteria in determining what constitutes a threat, with obvious implications for assumptions of responsibility for planning for chemical disasters.

Even when the public-private distinction is blurred, the very separation tends to reinforce a reluctance by public groups to assume responsibility. For example, hazardous chemicals are often transported on public roads or waterways, but the transporters are usually private companies. Our study clearly showed that planning for chemical disasters resulting from transportation accidents is seen as primarily other than local community responsibility. In fact, until the recent occurrence of dramatic transportation-based chemical disasters, extremely little attention was paid to the possibility of such events by any community public group or agency.

The public-private division also affects what spatial localities are covered by whatever chemical disaster planning is undertaken. There are often legal barriers between local chemical installations and the public emergency organizations in that community. This may take the form of insurance/compensation prohibitions against the use of public workers on private property. In-plant accidents, therefore, are not viewed as a general community concern. One consequence is often a lack of involvement by public organizations in chemical disaster preparedness for certain spatial areas even though they are within the operative community because they are viewed as private spheres of responsibility.

The problem is compounded by the fact that there is a tendency also for chemical disasters to occur in or around spatial localities for which responsibility is "unclear." For example,

transportation accidents tend to occur at points of entry into private property, at the juncture of private railway tracks and public roads, etc. Even apart from unclear private and public boundaries, disasters involving chemical agents are more likely to occur in geographic areas where coverage and control by the usual governmental groups may be either very complicated or very weak. Instances of the former are accidents involving hazardous chemicals which occur in port or river areas which almost invariably are cut across by a different variety of jurisdictions from different governmental levels. In such situations, no one may plan because of the assumption that other parties have responsibility. Even if there is disaster planning, it can still leave gaps in coverage unless coordination is very tight. On the other hand, complexes of chemical installations can be found away from built up residential areas, in sparsely populated zones, or in semi-rural locations. Such locations are often considered a nominal responsibility and to be weakly serviced by the emergency organizations in the community. Due to overlapping or nominal jurisdictions, parts of the geographic area of an operative community may not be covered by adequate chemical disaster planning.

Local responsibility for preparing for disasters from chemical agents is also partly undermined by the activities and actions of supracommunity organizations. It is true that along some lines such higher echelon activities have created sensitivity to the potential problem and have encouraged some community level planning which probably would not have otherwise occurred. In recent years, in the United States, federal and state legislation regarding the handling of hazardous materials has markedly changed both sensitivity and actual attempts to prepare for chemical disasters in the chemical industry as a whole and at some state levels. Larger national companies have issued policy directives and instituted programs relevant to chemical accidents on a large scale, and state agencies have set forth regulations which affect their subordinate private or public units. Such higher echelon activities have undoubtedly spurred some lower level activities.

On the other hand, this approach tends to discourage local initiative and reinforces the notion that disasters involving chemical substances are not primarily a local responsibility. The very social organization of hierarchical but diffused organizations leads to a separation between where policies are made and where operations are conducted. Thus, while plants in local communities produce the hazardous chemicals and the dangerous substances are transported by means of local roads, waterways, train tracks, etc, the control of general planning for many plants and transporters tend to be supracommunity. That is, many plants are simply local outlets for national and international corporations with headquarters elsewhere, and many of the transporters are subject to state and federal regulations which supersede local ordinances. Given all that is going on outside the local community, it is, therefore, not surprising that extracommunity sources of information and aid for chemical disasters are not widely known at the local level. The possible

exception to this is the existence of CHEMTREC. Only a few local organizations are aware of where they could turn, and even within these groups, the knowledge is often of a personal rather than official nature.

Yet, no matter what the preparedness and planning is at supracommunity levels, disasters involving chemical agents impact only at the community level. It takes time for supracommunity measures to be implemented, and for extracommunity aid to arrive. Thus, local communities have to prepare at least for the emergency period of chemical disasters. But as the DRC study shows, while there are marked differences from one locality to another, there is relative little community level planning for chemical disasters in American society. The matter is not seen as a general salient issue in most communities, and little effort is directed toward addressing the problem. The question is given low priority in overall community disaster planning compared to preparedness attempted with respect to other disaster agents. This is true even in localities where there is awareness of the possibilities and potentials for local chemical disasters.

Among other things, this lack of priority leads to different degrees of preparedness in the geographic area of the operative community. This unevenness of preparedness is reinforced by the division of social life into a public and a private sector. In turn, this typically means a lack of organizational leadership, poor knowledge of risks, and a weak resource base in preparedness for chemical disasters.

Greater effectiveness and efficiency in responding to disasters resulting from chemical agents can only come about through better preparedness and planning measures. This paper advances the beginning of a model which attempts to indicate some of the conditions responsible for the current status of community disaster preparedness regarding chemical hazards. In particular, we have singled out as a point of initial analysis the fact that the operative local community is not the equivalent of some formal governmental entity. This is merely a first step, but hopefully it represents a systematic beginning to an empirically based study of the problem of community preparedness for acute chemical disasters.

FOOTNOTES

- 1. Among the events examined were threats and disasters from chemical agents in Waverly, Tennessee; Youngstown, Florida; Midland, Michigan; Texas City, Texas; Mansfield, Ohio; and Baton Rouge, Louisiana. Although our study of these events was not conducted on a large, systematic scale, we examined the relationship of disaster planning in the involved communities to the organized response to the threats and dangers that developed in each particular event.
- 2. The communities selected were the following:

Akron, Ohio *Baton Rouge, Louisiana Big Spring, Texas **Buffalo, New York *Charleston, West Virginia Chattanooga, Tennessee **Cincinnati, Ohio Findlay, Ohio Galveston, Texas *Houston, Texas Kingsport, Tennessee Linden, New Jersey **Los Angeles, California *Midland, Michigan Mobile, Alabama **Savannah, Georgia

The ** indicates cities in which DRC had previously amassed considerable and systematic data about disaster planning; whereas, the * indicates cities in which DRC had done some field work on disasters but not on overall disaster planning.