

## INITIAL FINDINGS FROM A STUDY OF SOCIO-BEHAVIORAL PREPARATIONS AND PLANNING FOR ACUTE CHEMICAL HAZARD DISASTERS\*

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### Summary

This paper generally describes research just initiated on the socio-behavioral aspects of disasters resulting from chemical agents, and reports preliminary findings from the first phase of study. These initial observations are about the community and organizational preparations and planning for acute chemical hazard disasters. The results are drawn from data gathered on disaster preparedness in 14 communities and six major threats or actual disasters involving chemical agents in American society.

A model for describing and analyzing community and organizational disaster planning is outlined. Some initial observations are stated about how communities rank the probability of different kinds of disasters including chemical ones. We then present in general terms a series of findings about community and organizational perceptions and reactions with respect to chemical threats, resources to deal with such threats, the social organization of emergency related groups using such resources and the social climate in which the emergency groups operate. Some implications for planning are then indicated.

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### Introduction

In the last 20 years, considerable work has been done by social scientists on how people behave and how groups react to natural disasters such as tornadoes, floods, hurricanes and earthquakes [1,2]. These studies, which have mainly been undertaken in American society, have led to improved disaster planning and better recovery from such mass emergencies [3,4]. Social and behavioral 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, work has 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, the Disaster

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Research Center (DRC) is undertaking a three year study of disasters resulting from chemical agents. The focus of the research is on organizational and community preparations for, responses to and recovery from relatively sudden disasters resulting from chemical agents. Data is being obtained from field studies in the United States which involve extensive interviewing of police and fire departments; civil defense offices; hospitals; relief agencies; organizations involved in producing, transporting, storing and using dangerous chemical substances; and all other groups that would be concerned with sudden mass emergencies such as mass media units.

This study differs from others dealing with chemical accidents and disasters in at least five ways. Our interest is in the social and behavioral aspects of such events, and not in technical, engineering or purely chemical features. We are also interested in analyses of many events, not in the descriptive account of a single case. Our concern is as much with understanding the conditions responsible for the phenomena as it is in delineating their characteristics. We are also primarily interested in events with actual or potential major consequences for life and property, and not in everyday minor mishaps. Finally, our focus is only on acutely precipitated events and not on situations resulting from chronic or slowly developing factors. The field focus on the American scene probably creates some limits to the universality of our findings, but we do believe much of what we find has applicability everywhere.

In what follows, to provide background context, we briefly and generally describe the objectives of our overall research effort. The specific work of the first phase of the study is also noted. This includes a description of our methodology, especially our data gathering procedures. The concluding and largest part of the paper is a report of some of our initial findings and observations. The basic dimensions of our theoretical model are used to order the presentation of our preliminary analyses of our research.

### Objectives of the study

There are three phases to the study. During the first year of work, which concluded in August, 1978, the focus was on community and organizational planning and preparations for disasters involving chemical agents. Research was conducted in a total of 18 communities around the United States, exhibiting varying degrees of potential for sudden chemical disasters. Information was obtained through intensive interviews with key organizational officials, in both the public and private sectors, and also by the gathering and collecting of documentary and statistical data. Preliminary results from this first year of work are reported in this paper.

The second phase of the study is focusing on the emergency time period of actual incidents involving chemical hazards. DRC is making an effort to study all such major events and a sampling of other relevant incidents in the United States over a 15–18 month period. This research involves

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 American society 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 concentrate on the longer run consequences of, rather than the emergency time response to, sudden chemical disaster. An effort will be made to trace the effects of recovery from such a disaster on organizational and community planning for mass emergencies over a period of time. This will necessitate periodic revisitation of DRC to some elected localities previously experiencing major chemical catastrophes.

DRC estimates that at the conclusion of the work field research will have been conducted in at least 40 American communities in all sections of the country. Data will include approximately seven hundred in-depth interviews with government officials, industry personnel and emergency organization members; scores of sets of documents and statistical data; and hundreds of man-hours of observations of disaster operations. By the time the three year study will be finished, DRC will have amassed the largest collection of systematic data available anywhere on the social and organizational aspects of group and community planning for and response to sudden chemical threats.

### **Field work procedures and operations**

During the first year of the study DRC field work focused on community and organizational preparedness and planning for sudden disasters, especially those involving toxic releases, explosions, or other chemical agent emergencies. Our research objectives necessitated picking a sample of communities, deciding 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.

Many factors were considered in selecting the 18 American 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, Ohio, Tennessee and Texas, which have 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 planning.

The communities selected were the following:

Akron, Ohio; \*\*Cincinnati, Ohio; Findlay, Ohio; Chattanooga, Tennessee; Kingsport, Tennessee; \*\*Memphis, Tennessee; Big Spring, Texas; Galveston, Texas; \*Houston, Texas. Elsewhere in the country, the following communities were chosen: \*Baton Rouge, Louisiana; \*\*Buffalo, New York; \*Charleston, West Virginia; Linden, New Jersey; \*\*Los Angeles, California; \*\*Louisville, Kentucky; \*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.

Within each community, six organizations were examined so that a picture of the overall disaster planning 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 planning, 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 planning, 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—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 planning.

Our field operations went very well. Almost all organizations cooperated fully. Direct refusals to participate in our research on disaster preparations and planning were rare, thus allowing an average of several dozen groups and agencies to be studied in each community. The vast majority of officials contacted were cooperative in providing information and documentation. At the conclusion of this part of the field work, DRC had around 450 interviews available for analysis. Most of these interviews were over an hour in length. For purposes of citing details and making a record of quotable, although anonymous, remarks for future case studies, about a fifth of the interviews were tape recorded. Quantities of documents such as organizational disaster plans and statistical information such as community socio-economic characteristics were also collected.

Although our focus was on planning and preparations for disasters, DRC also studied a few actual chemical disasters in the first year of the research. 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 on a limited scale, we examined the relationship of disaster planning in the involved communities to the organized response to threats and dangers that developed in each particular event.

For each community or event studied, a quick and brief field trip report was prepared. Each report covered disaster threat possibilities in the community or the actual disaster event, organizational involvement in disaster preparations, the field team's general impressions or observations relevant to our research objectives, any problems in field operations which might have affected the data collection, and a listing of the data obtained. The reports were based on field impressions and observations and were intended solely to provide an initial basis for systematic data analysis. The material gathered in the field was also systematically processed when it was submitted to DRC. This was to insure that any gap in information was noted so that the missing data could be obtained via phone calls or by mail and also to insure that data which was to be mailed to DRC was actually received.

Field work in the second year of the study, which is focusing more on actual threats and disasters from chemical agents than on community and organizational planning, is generally following the procedures for the first year. However, different interview schedules are being used, and all organizations involved in the emergency time response in addition to those groups mentioned above are being studied. Emphasis is on obtaining data on disaster-related activities, on how the community response is organized and on lessons learned from the experience, as well as on examining the implementation in the actual event of whatever predisaster planning existed. As usual, the DRC approach concentrates on obtaining an objective picture of

what occurred and neither deals with technical issues and questions of blame, nor otherwise “investigates” the event since such matters are not within our research objectives.

### **Some initial findings and observations**

Because field data obtained has been so voluminous, it is not yet possible to report conclusive findings based on a systematic analysis of all the material obtained in the first year of work. Nevertheless, we have developed some tentative impressions about community and organizational planning for disasters resulting from chemical agents. Also, a few simple and partial analyses have been carried out. These impressions and preliminary findings, presented below, are subject to later modification and qualification depending on the currently ongoing qualitative and quantitative examination of all of the information amassed.

Our initial observations and findings must be seen in the context of the working model we are using to gather and analyze the data on community and organizational disaster planning. 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 planning. However, within any given community, there are always some capabilities for meeting such demands. These can be thought of as the physical and 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 disaster planning in the community). 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, rehearsals, 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 conditions.

In graphic terms, the model we are currently using is presented in Fig. 1. 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 climate.

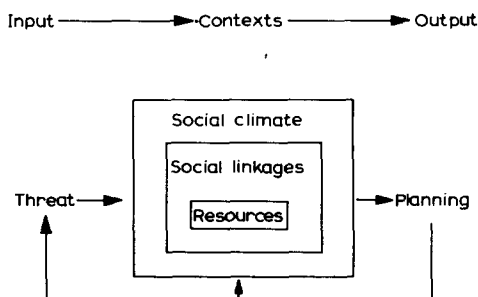


Fig. 1.

We first briefly present a few tentative conclusions drawn from a very partial quantitative analysis of the community disaster probability scale given to the first 125 of the officials we interviewed. This is followed by a presentation of other initial findings and observations grouped under the five basic dimensions of our model (i.e., threat, social climate, social linkages, resources, and planning). All statements made are based on a selective and still ongoing analysis of data from 14 of the sample communities where we studied disaster planning, and also on the six actual threats or disaster situations involving chemical agents which we examined.

#### *Community disaster probability*

Since all 14 communities studied are high to very high risk communities for chemically generated disasters and since a 10 year period for occurrence was specified, we expected that the probability of chemically generated disasters would be ranked high on a 1–5 scale. This was true for some communities, but not for others. In 9 of the 14 communities the probability of all three major chemical incidents cited (sudden toxic substance release, major plant explosion, and chemical spill) was ranked between 3 and 5, i.e., ranging between moderately probable and certain. In only one community were all three ranked as most highly probable, with a mean ranking of 4 (high probability). In all localities, high probability ranking was given to at least one chemically-related threat, although in terms of relative ranking, no disaster agents involving chemical substances were ranked in the top seven possibilities in three of the cities studied.

Significant differences among communities and types of organizations were evident even in the preliminary analysis. For the three major chemically-related threats, members of public emergency agencies and organizations gave statistically significant higher probability ratings than did either chemical company personnel or personnel in private and voluntary groups with disaster-relevant tasks. Estimates of a chemical disaster threat varied with community size as well, with those in smaller size communities assessing the risk of the three major chemical disaster agents lower than did their counterparts in medium and large size cities. The perceived relative

risk of natural and chemical disasters appears related both to community proneness to natural disaster agents and to recent experience with these agents. The agent which had most recently been experienced was given the highest assessed probability.

Thus, we find that awareness of chemical threats is widespread, but not universal, even in higher risk areas; smaller communities are likely to play down chemical threats; chemical companies tend to view the probability of chemical disasters as less likely than do public emergency organizations; and recent experience with an agent tends to lead to singling out that threat as having very high probability of occurrence. There is an indication that the quality and quantity of disaster planning is affected by these perceived aspects of the likelihood of disaster events in the communities studied. The validity of these impressions will be determined in the fuller analysis being completed which also includes other variables not mentioned above.

### *Threats*

(1) There is greater general awareness of the possibility of chemical disasters than there was even a few years ago. This increased awareness is particularly marked with respect to threats or disasters which may result from transportation accidents but is less notable for in-plant accidents. The general sensitivity to such kinds of disasters, however, does not always translate itself into the recognition of a possible local problem.

(2) Awareness among community emergency organizations about hazardous chemicals manufactured or processed in their community ranges from virtually non-existent to very high, but generally tends to be low. In many localities, the key safety organizations and their personnel (with the possible exception of fire departments) simply do not know the degree and kinds of chemical hazards which are present in their areas. Even in localities which have done good hazard or risk assessments of natural disaster agents and some types of technological disaster agents, the absence of concrete knowledge about local chemical risks is often conspicuous at the community level.

(3) Chemical companies tend to define potential threats from chemical agents in terms of their possible impact on company workers within the plant. Mass emergency agencies instead define such threats in terms of possible impact on the population at large. Thus, the public and private sectors tend to use different criteria in determining what constitutes a threat. The differences in approach make for difficulty between private companies and public agencies in trying to develop cooperative interactions about disaster planning.

(4) Chemical disasters resulting from transportation accidents are not uniformly seen as the responsibility of any given local organization. Responsibility tends to be attributed to a variety of groups including local fire departments or civil defense offices, the manufacturers of the product, and/or the transportation company. In fact, until the occurrence of recent dramatic



transportation-based chemical disasters, extremely little attention was paid to the possibility of such events by any community group or agency. Even now, the problem is usually defined by local organizations as primarily other than a local community responsibility insofar as planning is concerned and, to some extent, even insofar as response is concerned.

(5) Small size chemical companies not part of a larger multi-facility chemical corporation often do not see themselves as being a significant threat or source of potential disaster for the local community no matter how hazardous the products they handle. As a result of this perspective, they are highly reluctant to undertake any disaster planning, or to get involved in planning with other community groups. Even those that see themselves as a threat do not tend to spend money or time on the problem.

### *Resources*

(1) There is widespread recognition that evacuation is a central question to be addressed if there is to be planning for chemical disasters, although there is considerable uncertainty and lack of knowledge of what resources should be organized and how they should be mobilized for the problem. Thus, awareness of the evacuation problem is not matched by planning for the mobilization of the needed resources.

(2) The chemical industry mobilizes resources for special threats, whereas the public emergency organizations have to prepare to mobilize resources for a wide range of threats, both natural and technological. Therefore, the existence of general disaster resources per se does not automatically mean such resources are available for use in chemical disasters or vice versa.

(3) Coordination of resources in an actual disaster as projected by plans is often viewed as unlikely. Although responsibility for specific tasks and use of resources may be clearly spelled out in a disaster plan, there often is a lack of clarity about which agency has responsibility for overall coordination or the conditions necessary for the use of extra-organizational resources. The potential problem is magnified in the case of chemical disasters due to two reasons: (1) such incidents, being usually of a very sudden nature, necessitate immediate response by the fire services who direct their attention to neutralization and control, and have little time for establishing new liaisons or developing coordination; (2) there is a tendency for chemical disasters to occur in jurisdictionally "unclear" locations, for example, at points of entry onto private property, on railroad tracks, or in port or river areas cut across by different jurisdictions. Any situation calling for meshing of interorganizational resources where jurisdictional boundaries overlap or are unclear is a very problematic one.

(4) Knowledge of extra-community sources of information and aid for chemical disasters is not widespread. Only a few local organizations are aware of where they could turn, and even within these groups, the existing knowledge has been obtained on a personal basis rather than through official channels. Thus, groups and agencies which might need such information in a

threat or disaster situation, are likely to learn about it by happenstance rather than by design.

(5) Newer and more concentrated chemical complexes tend to be built in industrial parks and seem to engage in more intensive and extensive disaster planning than do older and more dispersed chemical companies. However, in general, as a result of zoning and land use policies, the newer complexes in industrial parks present less threat to surrounding areas than do older plants frequently located near residential neighborhoods. Therefore, more resources are sometimes being used for disaster planning in the less potentially hazardous areas.

### *Social linkages*

(1) In recent years federal and state legislation regarding the handling of hazardous materials has markedly changed both sensitivity and actual attempts to plan for disasters from chemical agents 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 disasters, and state agencies have set forth regulations which affect their subordinate private or public units. Such activities at the top of groups linked vertically have increased sensitivity to the potential problem and have encouraged planning at lower levels which probably would not have otherwise occurred, certainly not as rapidly as has happened.

(2) In communities racked by social cleavages and conflicts, overall community disaster planning is very difficult to initiate. If planning is being done where there are sharp differences between community groups, consensus and agreement on planning is difficult to achieve. While this does not distinguish situations involving planning for chemical disasters from those in which planning for other disasters is attempted, the difficulty is compounded in the former situation. In addition to overcoming usual intra-community conflicts, planning involving chemical agents also has to deal with a public/private sector split. Thus, planning for chemical disasters tends to be more difficult than planning only for natural disasters.

(3) Local fire departments are usually the major and often the only point of contact between local community emergency organizations and chemical companies in an area. This is often because of a shared professional concern with fire fighting expertise, which in some cases leads to informal linkages in spite of corporate and/or municipal legal dissuasion. One consequence of the general linkage is that knowledge of general community disaster planning and resources is scanty among local chemical companies. Similarly, most public safety agencies have little knowledge about what the companies have and could do in a major emergency.

(4) Most formal, detailed local planning is vertical in nature (i.e., within an organization or task area) rather than horizontal (i.e., across organizations or task areas). This leads key people to be knowledgeable about the disaster task functions of their own organization but to be unaware of the tasks functions

of other organizations. Crucial information on how to prepare for and respond to a chemical threat or a disaster, therefore, often flows within rather than across relevant community groups and agencies.

(5) Those large chemical companies that have become sensitive to disaster possibilities have shown in recent years a marked inclination to share their ideas about disaster planning and safety information with others.

### *Social climate*

(1) Recent chemical disasters spotlighted by the mass media have generally suggested technical rather than organizational problems to distant officials who hear about them. Official interest that has been generated has usually been in the technological, mechanical, or engineering aspects of the events, rather than in the human or social factors involved in preparing for and organizing responses to such community mass emergencies, an example being planning efforts to ensure coordination.

(2) There is the widespread view that implementation of disaster planning can only be done a step at a time because there is little community support for extensive planning or radical changes. However, it is general indifference or unconcern among citizens rather than opposition or resistance which supposedly prevails. In addition, community officials perceive the public as being fiscally conservative with regard to preparing for such unpredictable, uncertain and relatively infrequent events such as disasters.

(3) There are often legal, psycho-physical and perceptual barriers between local chemical facilities and the community response agencies. The first takes the form of insurance/compensation prohibitions against public workers being utilized on private property. The second most often develops when medical, rescue and police services are not properly equipped or cognizant of the hazards of a chemically inundated area. The last barrier to action exists when the public resource administrators are often reluctant to jeopardize a dependency relationship with a company (which provides wages, taxes, gratuities, etc.) by facing the issue of risk assessment through shared knowledge of hazardous materials threat and response potential.

(4) While elements of the mass media are sometimes brought into the planning process, it is often with the view of using them as public relations outlets rather than as instruments of education or information. The basic goal frequently is to create a good image of the organization and a perception that something is being done. Thus, the media are, at times, used for individual organizational purposes, not for the collective or public good. In addition, it is common for both governmental and private organizations to see themselves as having a primarily adversary relationship with mass media groups.

(5) There are some legal and economic factors which act as powerful forces for many in the chemical industry to undertake disaster planning. Among the incentives to plan are possible lower liability insurance rates, benefits companies can realize by pooling resources in mutual aid networks,

and the possibility of reducing corporate costs in law suits. At the same time, some attempts at interorganizational coordination are not undertaken because of possible legal ramifications.

### *Planning*

(1) There are certain distinctive patterns noticeable in the local planning for natural disasters. However, no one pattern seems to predominate in planning at the community level for disasters resulting from chemical agents. There is considerable variation nationwide as to who is seen as primarily responsible for planning at the local level, and also in regard to what resources are seen as necessary to deal with the problem of a chemical disaster if it should arise.

(2) While there are marked differences from one locality to another, there is relatively little community level planning for chemical disasters. The matter is not seen as a general salient issue in most communities and little effort is directed toward addressing the problem. The problem has low priority in overall community disaster planning. This is true even in localities where there is awareness of the possibilities and potential for local chemical disasters.

(3) Omitted from almost all disaster planning for chemical agents is the fact that if the disaster is a very large one, it will probably involve national response teams, and that in the vast majority of cases of sudden disasters, the local police will be the first responders. Failure to recognize this means that certain crucial interorganizational contacts and interactions likely in actual events may not be any part of an existing plan. It is not surprising in the actual incidents we have studied that there frequently have been major coordination problems between local and extra-community response agencies.

(4) If one major organization in a community takes the lead in preparing and planning for chemical disasters, there is a tendency for other local groups to defer to that organization irrespective of their role in overall community planning. Due to the specialized interests and expertise of the lead organization involved, one possible consequence of this is sometimes an unbalanced emphasis in the preparation and planning for disaster tasks and relevant resources.

(5) Planning for plant safety incidents and planning for disasters tend to be viewed as the same thing in many chemical companies. At best the two are seen as points on a continuum. That there might be a qualitative difference in the planning necessary and response required for the two kinds of situations is often not recognized.

### *A few concluding observations: Some paradoxes of planning for chemical threats and disasters*

(1) The principal need for planning is from those currently least involved in planning. Chemical facilities that engage in the most planning are not the

ones that most need to plan — at least from the perspective of the communities in which they are located. Examples include large, wealthy, safety-minded corporations as opposed to smaller local companies which can ill afford elaborate safety planning, and modern chemical complexes, located far from areas dense in population, as opposed to individually isolated older facilities near residential neighborhoods.

(2) Chemical companies tend to see disaster planning as an extension of everyday safety planning. One consequence of this is that, when an in-plant accident occurs, all energy is directed to containing and reducing the threat, little to informing the community of the attendant hazards should the threat not be contained. In the event that containment efforts are not successful, this entails a greater hazard for the affected community due to lost warning time.

(3) In contrast with the natural disaster situation, there is no one organization on the local level which has responsibility both for planning and responding to disasters resulting from chemical agents. Civil defence has both planning and operational responsibility in the former [5], while in the latter, the local organization most likely to be prime responder, the fire department, is usually not involved in comprehensive planning for the response. Interesting also, while most fire departments see themselves as having the prime responsibility for handling out-of-plant chemical disasters, few other emergency relevant organizations assign that responsibility to the fire services.

(4) As is the case with natural disasters, the first responders for chemical disasters are overwhelmingly likely to be local organizations. However, in contrast with the natural disaster situation, the most firmly established and routinized procedures for dealing with chemical disasters involve links with extra-community groups and organizations, such as the manufacturer of the chemical or the parent company in the case of a chemical plant.

Our ongoing systematic analysis will determine the full validity of these preliminary observations. The current DRC studies of actual disasters resulting from chemical agents will establish the relationship between disaster planning and disaster response. Research into these kinds of problems in societies other than American society will indicate how universal are the findings. When all these things are done, it will be possible to claim some solid understanding and knowledge of socio-behavioral preparations and planning for major and acute chemical hazard incidents.

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