Journal of Hazardous Materials, 8 (1984) 239—249
Elsevier Science Publishers B.V., Amsterdam — Printed in The Netherlands

CHEMICAL DISASTER PREPAREDNESS AT THE LOCAL COMMUNITY LEVEL*

E.L. QUARANTELLI

Disaster Research Center, Department of Sociology, The Ohio State University, Columbus, OH 43210 (U.S.A.)

(Received July 8, 1983; accepted August 22, 1983)

Summary

The results of a four-year study in the United States of organizational preparedness in local communities for actual and potential sudden disasters resulting from chemical agents, are reported. Especially noted are the problems in planning which stem from the fact that the operative local community is seldom congruent with the formal jurisdictional area of a community. Differences between planning for chemically-based disasters and for natural disasters are also discussed.

Introduction

Since by most criteria the threat of acute chemical disasters is on the increase, the Disaster Research Center (DRC) conducted a four-year study of community and organizational preparedness for and responses to actual and potential sudden disasters resulting from chemical agents. Forty-four field studies were carried out using a general theoretical framework derived from earlier work (see Gray and Quarantelli [1]). In the first phase, DRC undertook 19 separate field studies of local community preparedness for acute chemical emergencies. This paper, after indicating how we approached the problem, summarizes the findings on certain aspects of that work (for other aspects, see Tierney [2]).

Possible approaches to the problem

There are many ways in which the problem of preparing for the sudden release of hazardous chemical substances could be approached. There are different levels of social organization which could be involved. Thus, DRC might have looked at the problem from a societal viewpoint, focusing perhaps on the relevant federal organizations, national transportation systems,

*The data used in this article were obtained under grant PFR-771445 from the National Science Foundation (NSF). However, all statements made represent the views of the author and the Disaster Research Center, and not necessarily those of NSF.

0304-3894/84/$03.00

and corporations with multiple facilities scattered around the country. For example, we might have examined what immediate response capabilities are available, on the national level, from the regulatory agencies, the transporters, and the producers of hazardous chemicals. Or we might have focused on the state level, examining and comparing how the problem is handled within these intermediate level social entities. For instance, we might have studied the regulation and enforcement practices in different states regarding the production, distribution, and use of dangerous chemicals.

We chose instead to focus primarily upon the local community level, and secondarily on those organizations within the communities which are somehow involved with the problem. DRC thus looked at the public safety and emergency-relevant community organizations as well as at those private groups concerned with the production, transportation, and storage of hazardous chemicals.

Our focus on the local community level was not an arbitrary choice. Higher-level social entities are pertinent to understanding the problem and we did treat them as significant extra-community factors in the local situation. But sudden disasters emanating from chemical agents occur almost exclusively at particular geographical locations at specific points in time. They seldom impact simultaneously over large areas as do hurricanes, floods, and earthquakes. Furthermore, the initial responders to such kinds of crises necessarily have to be relevant organizations within the nearest local communities. It takes time for outsiders to converge upon the disaster area. Furthermore, what the first responders do by way of identifying and attempting to deal with the threat frequently determines whether the situation will remain a minor mishap or escalate to a major disaster. Thus, however important supracommunity factors may be, local preparedness is always crucial. Accordingly, it seemed appropriate, at least in our initial approach to the problem, to use the local community as the basic unit of description and analysis in our study of 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 used for different research objectives (see Poplin [3]). For our purposes, we considered a community to be 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. From a slightly different perspective, 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 is not necessarily congruent with the formal boundaries of standard governmental units, be they a country, a city, a township, or some other incorporated legal entity.

The very concept of community suggests that what goes on within the formal boundaries of legal entities often does not adequately portray the ways in which people and groups collectively organize themselves to handle problems. Thus, for example, community preparations for handling chemically-based disasters cannot be wholly understood by looking solely at the situation in the area's primary governmental entity, the city. Other adjacent governmental units, which may include other cities, towns, villages, or incorporated areas, are usually part of the "community" in that locality, and their degree of preparedness must also be understood to gain an accurate comprehension of the situation.

The descriptive and analytical importance of this point goes beyond the idea that multiple governmental entities may comprise 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?

We also have to recognize that there are varying bases of organizational authority within United States communities, with complex 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 quasi-public groups such as most utility companies, and others such as railway companies which, while privately owned, are subject to detailed public regulations. Finally, there are the private organizations, from corporations to proprietorships. Different communities have varying combinations of these four kinds of organizations, and who has influence, power, and authority over whom may be a very intricate matter. As an illustration, there is the phenomenon of the so-called "company town", where public authority is often secondary to private influence and power. We found communities where the local chemical industry was so dominant, that they could be approached as "company towns".

Another complicating factor is the uncertainty whether certain geographic areas, given their unofficial status, are part of the community's concern, and which organizations, if any, have responsibilities within particular nearby areas. Especially outside city limits (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 emergencies may be influenced by inconsistent legal statutes, informal interorganizational understandings, and traditional practices based on often long forgotten historical happenings. In an earlier DRC study on the delivery of emergency medical services, it was not infrequently found that the utilization of those ambulance services and hospitals involved in the delivery of such services resulted from a mixture of the just-noted factors (see Quarantelli, to be published).

A final complicating factor we might note is that the relationship of supracommunity organizations to the local community can be complex and indirect. In the United States, there is no automatic and direct imposi-

tion of authority from the top down, even though there is a formal governmental hierarchy from federal to state to a local entity. Lower-level governmental units have different degrees of autonomy which are protected by law, as well as by an ingrained wariness of political intervention from the top. On the other hand, higher-level organizations have at their disposal a variety of direct and indirect mechanisms to implement changes. These range from publicity and recommendations to mandatory program requirements to legislation. For example, the United States government does not through federal law directly impose land use restrictions on flood plains, but does indirectly try to effect disaster preparedness by making the availability of federal funds contingent upon the acceptance of flood measures and other actions which can only be initiated by local entities (see White [4]).

Our basic questions

Having chosen the local community as our basic unit of description and analysis, we could then ask some basic questions. For our research purposes, these were four in number:

(1) Which community organizations had responsibility for preparing for sudden chemically-based disasters? Furthermore, and more specifically, which formal group of the many operating in the community was salient in taking the lead for such disaster preparedness?
(2) What was the philosophical basis for the assumption of responsibility for the preparedness attempted in the community? Furthermore, and more specifically, which sector, the public or private, prepared for acute chemical disasters?
(3) What was the geographic extent of the responsibility assumed in the chemical disaster preparedness? Furthermore, and more specifically, were all parts of the operative community equally covered in the planning for sudden chemical emergencies?
(4) What was the relationship of the planning of supracommunity organizations to that at the local community level? Furthermore, and more specifically, were some aspects of preparedness of disasters resulting from chemical agents seen as other than local organizational responsibility?

Essentially, these four questions reflect the fact that the operative local community is not necessarily congruent with some formal governmental entity. Thus, in order to understand preparedness for sudden chemical disasters, it is necessary to know the salient disaster-relevant organizations in the operative community, the basis of disaster preparedness responsibility assumed by organizations within that community, the geographic area for which responsibility is assumed, 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 (see Quarantelli and Tierney [5]), but it does address some of the matters we consider important.

Findings from the study

The usefulness of our approach can perhaps be illustrated in two ways. We will provide examples of what we found when the four basic questions were asked. We also suggest an explanation for the differences in the answers obtained when a distinction is made between community preparedness for natural disasters as compared with chemically-based disasters.

In most American communities, research by DRC and others has 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 (see Dynes and Quarantelli [6]). 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 means that the organization is the lead agency 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 Emergency Operation Center, 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 include some extra-community 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 include sudden chemical disasters, there is seldom one organization which assumes the responsibility. We found 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 organizations; 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 is very rarely expressed by an assumption of a lead role in the operative community. Thus, there typically is no single organization with major responsibility for overall preparedness for disasters from chemical agents in most communities.

Given these conditions, it is not surprising we found it rare for any local organization to undertake 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 trans-

porters as railroads may be aware of hazards from their own functioning, although even this information is reluctantly shared with other community groups. Some local governmental environmental agencies arrive at some understanding about the kinds and range of chemical risks in their localities, but such knowledge is usually not systematically acquired. We also found that even among community emergency organizations, awareness of the specific hazardous chemicals manufactured or processed in their area tended to be very low. Thus, in the overwhelming majority of American communities, there is neither one organization nor a collection of organizations which could or can provide a comprehensive chemical risk assessment of the area.

Furthermore, no local organization normally attempts to bring about coordination among the community groups which 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. However, 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 (see Gabor [7]). But such systems are not found everywhere, including communities with fairly obvious potential risks. Most localities simply lack the lead organizations attempting to coordinate the activities of groups preparing for chemical disasters.

Given the usual lack of coordination, there will often 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 display 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 usually police department rather than fire department personnel will be first on the scene of (at least) transportation-related chemical disasters. Yet the police have much less knowledge of the resources needed than fire personnel. 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 is seldom a local source which can quickly 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 to do. Local fire departments are usually the major (and often the only) point of contact between local emergency organizations and chemical companies within 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 absent among local chemical companies. Similarly, DRC found most public safety agencies knew little about what the companies were prepared to do in a major chemical emergency.

But preparedness also depends, in part, 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 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). In contrast, mass emergency agencies, primarily public, define such threats in terms of possible impact upon the population at large and upon 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, very little attention was paid to the possibility of such events by any public group or agency in the communities we studied.

The public—private division also affects which physical locales are covered by whatever chemical disaster planning is undertaken. There are often legal barriers which hinder on-site cooperation between local chemical installations and the public emergency organizations, including 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 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 also a tendency for chemical disasters to occur in or around spatial areas for which responsibility is "unclear". For example, transportation accidents tend to happen at points of entry into private property, at the juncture of private railway tracks and public roads, etc. Even aside 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 reflect a variety of governmental jurisdictions. In such

situations, no one may plan because of the assumption that other parties have responsibility. Even if there is disaster preparedness, there can still be 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 are 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 supra-community 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. 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 public units. Such higher-echelon activities have undoubtedly spurred some lower-level activities. We found some evidence of this in the communities we studied.

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 tends to be supra-community. 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 extra-community 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 are at supra-community levels, disasters involving chemical agents impact only at the community level. It takes time for supra-community measures to be implemented, and for extra-community aid to arrive. Thus, local communities have to

prepare at least for the emergency period of chemical disasters. But as the DRC study showed, 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 generally 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.

Some paradoxes

There are many interesting paradoxes in the planning for chemical threats and dangers. Among the major ones are the following:

(1) 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 accidents and catastrophes as points on a continuum, and thus to see disaster planning as an extension of everyday safety planning. One consequence 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 for both planning for, and responding to, disasters resulting from chemical agents. Civil defense has both planning and operational responsibility in the former, 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 routine 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.
(5) Newer and more concentrated chemical complexes in industrial parks seem to engage in more intensive and extensive disaster planning than do older and more dispersed chemical companies. In general, however, as a result of zoning and land use policies, the newer complexes in industrial parks present less threat to surrounding areas than do older companies frequently located near residential neighborhoods. Therefore, more resources are sometimes being used for disaster planning in the less potentially hazardous areas.
(6) Planning for plant safety incidents and planning for disasters tend to be viewed as the same thing in very many chemical companies. At best, the two are seen as points on a continuum. It is often unrecognized that there might be a qualitative difference in the planning necessary and response required for the two kinds of situations. Accordingly, preparedness which is excellent for accidents may lead to a mistaken belief of being prepared for disasters.
(7) If one major organization in a community takes the lead in preparing and planning for chemical disasters, there is a tendency for other local organizations to slack off. Due to the specialized interests and expertise of the lead organization involved, one possible consequence is sometimes an unbalanced emphasis in the preparations and planning for disaster tasks and relevant resources. More important, it is possible overzealous organizational leadership may discourage across-the-board active involvement of other groups in preparing for chemical emergencies.
(8) While pre-planned mechanisms exist for obtaining information and expertise as well as mobilizing specialized personnel and equipment, the initial and prime responders to a chemical incident usually have major difficulty in simply identifying what, if any, hazardous materials are involved. This is especially true in transportation accidents where multiple chemical substances often are involved.

Overall, we can conclude from our research findings that disaster preparedness for chemical emergencies is neither accorded high community priority nor systematically addressed. Not only does planning for chemical disasters suffer from the problems attendant to all general disaster planning in American communities, but it also has additional problems of its own. In particular, disaster preparedness for chemical emergencies is plagued by the public—private sector division in our society, and also by the fact that the local community (which necessarily has to be the first responder) has generally less capability and knowledge for dealing with chemical emergencies than do extra- and supra-community social entities.

To what extent the DRC findings can be extrapolated to societies other than the United States, can only be settled by future studies. However, some research already conducted in Japan (for example, Ikeda, [8]) and elsewhere, suggests that there may be many common aspects. Few communities in the world seem very well prepared at the local community level for sudden chemical disasters, although when there has been some planning, even a massive evacuation such as occurred at Mississauga, Canada can be carried out with dispatch and efficiency (see Scanlon and Padgham, [9]).

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