

CHARACTERISTIC PATTERNS OF AND VARIATIONS IN COMMUNITY RESPONSE TO ACUTE CHEMICAL EMERGENCIES

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ABSTRACT

This paper discusses the distinctive socio-behavioral patterns which emerge in the context of community response to acute chemical emergencies. Impact contingencies and the variations in behavior they occasion are especially noted. The characteristic pattern of behavior of first responders and their initial definitions of threat are also outlined. In addition, there is a discussion of the effects of convergence movement towards the disaster site on the outflow of evacuees.

INTRODUCTION

Observations of organized behavior in chemical disasters have provided a number of research findings which are relevant to preparing for and responding to such occurrences. This paper discusses socio-behavioral characteristics or patterns of community and organizational response to acute chemical emergencies. In addition, the effects of specific conditions or situational circumstances on the quality of the response or outcome are also examined.

It has long been argued by Disaster Research Center (DRC) researchers that it is more feasible to develop plans which are in accordance with our knowledge of human behavior than it is to produce plans which expect human beings to exhibit behavior contrary to their normal actions. Since this paper identifies the collective and organized behavior patterns likely to prevail during the emergency time period, it should be useful to those involved in planning community responses to chemical incidents. Furthermore, the description of some of the more problematic aspects of response should prove helpful to those charged with responsibility for responding to such incidents by alerting them to the difficulties typically encountered in a chemically related disaster response.

IMPACT CONTINGENCIES

Impact contingencies or situational circumstances can greatly influence the degree

to which any community can effectively respond to a particular disaster. For discussion purposes, these contingencies can be divided into two categories: agent variables and situational variables. The response to an acute chemical emergency will be influenced by differences in agent characteristics as well as variations within the social context of that particular situation.

The specific nature of the chemical agent involved in a major accident can affect the degree of threat posed to a particular environment. These agent characteristics can be discussed in terms of the chemical's destructive potential and controllability. Both of these characteristics have implications for the manner in which the community perceives and attempts to neutralize the threat.

The destructive potential of any disaster agent refers to the amount of damage it is capable of generating. Certain chemical agents have a greater accident potential than others, such as those which are extremely volatile or unstable in terms of molecular structure. The inherent dangers of compressed gases or the threats posed by gases such as butadiene and vinyl chloride, which are both highly reactive and have a tendency to polymerize, exemplify some of the problems which chemicals having a high risk potential present.

Chemical agents are generally perceived to possess a high degree of uncontrollability by most community officials. The chemical agent's controllability, however, is primarily dependent on three factors: the chemical properties of the agents involved; the volume of chemicals involved; and the community's response capability during the critical time period immediately following the onset of the disaster.

It is important to note here that the manner in which the chemical agent is perceived is highly influential in terms of how its effects will be handled by the social unit experiencing them. The public's threat perception of chemical agents is quite often inaccurate. In general, the chemical agent's destructive potential is largely misunderstood by the public. Many times, both the general public and emergency officials tend to overestimate the destructive potential of a chemical agent, as they do in the case of a nuclear agent. Similarly, the agent's controllability in terms of its chemical properties is frequently misjudged.

One reason for this general misunderstanding of the chemical agent's characteristics may be the public's lack of an experiential point of reference from which it can view chemical and other technological threats. Chemical agents are ubiquitous in our society but random in their hazardous manifestations. That is, the threats posed by chemical agents are not restricted to certain regions or areas in the country; they are nonspecific agents in this respect. For example, unlike many natural disaster agents such as hurricanes and earthquakes, the impact of chemical agents is not confined to certain geographical areas. Therefore, it may be unlikely that any given population group has had much experience with major chemical disasters. Consequently, the image of the danger posed by the chemical agent is vague and tends to be exaggerated.

Another possible reason for this distorted image may involve the multiple, hazardous consequences of some chemical disasters. In acute chemical emergencies there is often a multiple disaster occurring either concurrently or sequentially. For instance, if a train carrying hazardous materials derails, the disaster may be manifested in several ways. The derailment itself will cause problems for the community; fires and explosions occurring as a result of the derailment present a specific threat to the community; and the possibility of a chemical spill or toxic cloud poses yet another specific threat. Each of these consequences is different in terms of the types of demands placed upon the community. Different disaster-related demands will create different disaster-related tasks for the community and, therefore, influence the community's ability to respond to the disaster. Consequently, the multiple effects of chemical disasters have implications for how the situation is viewed and how protective and response-related action is perceived.

Situational factors, the specific social context in which a chemical disaster occurs, will also influence the manner in which a community responds to the emergency. A chemical disaster or impact occurs at a particular time and place; a disaster can occur in or on private property, a mixed public/private setting, or a public setting. The location at which a chemical disaster occurs can influence the patterns which emerge in terms of the emergency response. For instance, an accident can occur in different geographical and demographical settings, such as a rural or urban environment. This in turn will have implications for response capability. The resource capability will vary according to different social settings as will the mobilization of the response and the magnitude of the disaster in terms of population threats. Furthermore, interjurisdictional and interagency problems may arise depending on the location in which a disaster event occurs. Jurisdictional domains are often vague at best; therefore, if an event occurs near the boundaries of two or more different jurisdictions, ambiguities may surface as to who is responsible for responding to the disaster. Similarly, depending upon the magnitude of the disaster, a number of representatives from different jurisdictional levels may respond to the event. This may compound jurisdictional problems since there are often discrepancies in regard to responsibilities among different governmental sectors. That is, they do not correspond and are not equivalent. Authority in disaster response tends to be "top heavy." In other words, if a disaster is large enough to necessitate a response from state, regional, or federal levels, the authority will be vested in these representatives as opposed to local responders.

The time at which a chemical disaster occurs has important consequences for response since each community has its own characteristic pattern of time and activity. This is referred to as social time and is not equivalent to chronological time. The activities of every community change over time. These patterned activities vary in relation to the time of day, the day of the week, and seasonal fluctuations. Social time affects where people are, what they are doing, and the state of readiness of

emergency organizations. This has implications for the mobilization of counterforces, warning, evacuation and convergence. In fact, the time at which a disaster event occurs will even influence the capability to identify the particular chemical agent since social knowledge is not uniformly distributed. Thus, social time is a factor in the discontinuity of social knowledge.

CHARACTERISTIC PATTERNS OF RESPONSE

The discussion thus far has focused on the impact contingencies or situational circumstances associated with a chemical disaster event. The following section of the paper will describe the characteristic patterns of response by referring to some selected research findings from the second phase of the DRC chemical hazard study. The comments are organized around seventeen general findings which, for discussion purposes, are grouped into two categories: first responders and initial definitions; and convergence and outflow.

First Responders and Initial Definitions

Identification of the specific nature of the chemical threat is at times problematic. The patterns differ somewhat between fixed and in-transit chemical incidents. For instance, the findings indicate that first responders in transportation incidents seldom perceive a dangerous chemical threat in the absence of obvious sensory cues, such as a pungent odor or discernible toxic cloud. Typically, these incidents are simply viewed as transportation accidents; not in-transit incidents involving hazardous materials of any kind. Furthermore, disaster plans rarely discuss the possibility of a hazardous chemical incident occurring in the context of a transportation accident. Therefore, there is an initial tendency for local responders to employ their organizational standard operating procedures (SOP's) for routine accidents rather than activate disaster plans for hazardous materials incidents.

As the nature of the chemical threat becomes clearer, however, there is a tendency to try to adjust organizationally to the newly recognized situation. Prior experience with emergencies is likely to positively influence the adjustment process. Yet, there is usually an ad hoc quality to much that is done, or at best very gross moves towards attempting to implement disaster plans.

When responding to transportation incidents, first responders do not always note hazardous materials placards and symbols. Even when they do notice them, they often do not fully understand their meaning. If a search for identification materials is initiated, invoices or shipping papers are generally difficult to locate and are not always understandable when found. Furthermore, personnel from the transporting carrier are sometimes killed, injured or otherwise unavailable for questioning. Many times they are unaware of exactly what they were carrying or are reluctant to provide relevant information to local emergency responders. Therefore, even when first responders recognize that more than a routine accident has occurred, they are frequently

uncertain as to the specific nature of the chemical threat.

Efforts to identify the exact nature of the threat are beset by a number of additional difficulties. At times, the toxic substances involved in the incident are incorrectly identified. An incorrect identification may be diffused to many others through rumors among local officials outside a chemical plant or near a transportation accident site. Moreover, even if identification of the chemical agent(s) is correct, an equivalent recognition of the specific dangerous nature of the threat does not necessarily occur. Very frequently, the possible synergistic effects of hazardous chemicals are initially overlooked. For example, the various kinds of hazards posed by the possible interactions of a variety of chemicals shipped on the same train or in the same truck are frequently unacknowledged by first responders. Similarly, possible volatile reactions which can occur between certain neutralizing agents and the chemical substance involved in the incident (e.g., water and calcium carbide) are frequently ignored by primary responders.

Research findings indicate that chemical company personnel often fail to promptly notify local authorities about fixed installation accidents even when the development of a threat outside the plant grounds appears imminent. Community emergency officials often learn of the danger through secondary sources and/or sensory cues. This lack of communication between public and private sector personnel often leads to an unclear understanding of the exact nature of the threat by local officials. Many times this uncertainty persists after it is generally recognized that the community may possibly be endangered.

As a rule, the notification process in response to chemical incidents is highly uncoordinated. Notification of a chemical threat is usually communicated through different organizational channels rather than through a centralized emergency-relevant entity. This is likely to result in confusion over which groups and organizations have been alerted to the problem. Producers and transporters of dangerous chemicals involved in an accident are likely to immediately notify higher levels of their organization and often fail to promptly notify any public sector organizations, if they do so at all. Furthermore, the data indicate that even when fire department personnel have correctly identified the particular chemical agent, they are usually so site-oriented that they often fail to communicate this information to other responding groups. This frequently results in off-site decision-making that is independent of or uncoordinated with on-site information. While police departments are more likely to attempt to notify other relevant organizations about a dangerous chemical incident, they often do not have complete and accurate information about the threat. Thus, communication about an acute chemical hazard tends to diffuse slowly and erratically.

Overall coordination rarely occurs during the initial phases of a chemically related response. In the event that early coordination does develop, it tends to be of an informational rather than task-oriented nature. Information is exchanged, but a

comprehensive, interorganizational strategy rarely emerges initially. Rather, most organizations tend to operate on their own initiative and independently of one another. This pattern may change as the response becomes more protracted, but many times it prevails throughout the entire emergency time period.

In general, fire departments, with the exception of those in large metropolitan areas and some other isolated cases, are not well prepared to effectively respond to most chemical emergencies. They often lack the appropriate equipment and protective gear and have had little training or experience in the area of chemically related response. Moreover, an alarming number of fire departments are unaware of extracommunity sources of information and expertise which could be contacted and utilized in the event of a chemical incident. This is understandable when one considers that an estimated 80 percent of all fire departments in the U.S. are of a voluntary nature and lack the necessary funds for obtaining many of these resources. However, this general lack of relevant knowledge and resources can lead to dangerous situations since these organizations are very often among the first responders and are usually the central organization in a chemical disaster response.

As mentioned in the discussion of situational variables, social knowledge about correct identification and, hence, correct neutralization procedures is not always widespread at the local level. Even in cases in which the chemical threat is correctly identified, fire department personnel (those most likely to be directly responding to the danger) may act inappropriately. Quite often, fire-fighters will engage in their programmed activity or traditional practice of immediately applying water on a blaze which in some cases can be a fatal error. Similarly, even trained emergency response teams from the private sector may act in a manner which is inappropriate for the nature of the threat, thus possibly endangering themselves as well as others.

Convergence and Outflow

It has been found that the process of seeking outside aid and expertise in chemical incidents is usually uncoordinated. In certain instances, there is a delay until some organization decides to take the initiative in soliciting outside assistance. More often, however, various local organizations and groups independently request extracommunity assistance and are unaware that others are doing the same. This frequently results in more requests for outside assistance than is necessary. Consequently, the typical problem of post-impact convergence in disasters is observed in chemical incidents.

Post-impact convergence affects the manner in which the overall response proceeds, especially in terms of overall coordination. DRC research indicated that the longer a chemical incident continues the more likely some type of interorganizational coordination will develop. This may be due, in part, to the fact that extended, major emergencies will attract a number of extracommunity groups from both the public and private sector. The introduction and convergence of new groups and organizations

into a community are likely to compel different organizations to address the need for coordinating task responses.

Another effect of convergence on response involves the establishment of an on-site command post. As the response becomes more protracted and as more agencies or groups become involved, primary responders usually find it necessary to activate a facility for purposes of central decision-making and information exchange. In most cases, the command post is informally organized, under-equipped in terms of communications hardware, and lacks clear leadership. Law enforcement personnel tend to form the core of the command post; whereas, civil defense officials, those typically responsible for community emergency planning, usually only play a major role in disasters of very large magnitudes.

While an on-site command post is often set up in chemical incidents, it is extremely rare for an emergency operating center (EOC) to be activated. The absence of an EOC can affect the quality and quantity of information disseminated to the public. It has been found that the quality of public information about acute chemical emergencies is generally very low. If sources of public information gain access to the on-site command post, many of the responders may provide only partial or fragmented information. This results in the circulation of incomplete, conflicting and often erroneous information about the incident during the emergency time period. The lack of complete and accurate information about the chemical threat can have serious consequences for the coordination of the overall community response, especially when private citizens are expected to elicit appropriate adaptive behaviors such as evacuating the area or seeking shelter.

Most population evacuations in chemical disasters occur as a result of word-of-mouth communication in primary group networks. Regardless of whether the evacuation is spontaneous or delayed, formal or informal, most evacuees are contacted by friends or relatives and withdraw from the threatened environment as a result of the contact. Given this common pattern of primary group communication and rapid exodus, there is seldom time to activate formal evacuation plans.

Mass media units rarely play a role in the initial evacuation of a population group since the movement occurs so rapidly. At best, radio and television stations serve as a means of secondary confirmation of initial warnings. Radio stations can be instrumental in recalling a population into the area once the threat has been neutralized; however, in many instances no formal or official recall order is issued.

Although evacuation warnings in response to chemical incidents are generally effective in moving people out of hazardous areas, they, nevertheless, are inadequate in certain respects. For example, most evacuation orders are non-directional and ambiguous in chemical incidents. That is, people are urged to leave but are seldom given geographical directions, information about final destinations or safe spacial distances, or instructions on alternative protective measures. If evacuation involves the widespread use of private vehicles, officials rarely consider the possibility of

traffic congestion occurring when no directions for evacuation are provided. Similarly, methods of informing evacuees of the developing situation or of the fact that the danger has subsided are not usually predetermined by responding officials. Many of these problems stem from the unclear and undefined role that the agency normally central to most disaster-related community evacuations, the local civil defense office, plays in sudden chemical disasters.

Finally, research indicates that medical treatment of casualties in acute chemical emergencies is very poorly handled. In the majority of cases, ambulance services and hospitals are not informed of the exact nature of the dangerous chemicals involved in the incident. Furthermore, hospitals usually have had no prior experience with chemically created illnesses and medical personnel are typically unfamiliar with symptoms of chemical exposure and the associated medical treatments. In addition, most hospital disaster plans do not discuss the special problems associated with the treatment of chemical exposure victims. Moreover, health sector personnel are not aware of a clearinghouse or the equivalent of a poison-control center to contact for information and assistance. Consequently patients are on occasion treated for the wrong toxic illness because the symptoms are misinterpreted.

IMPLICATIONS

In conclusion, it is evident that the general characteristics or patterns of community response to acute chemical emergencies reflect numerous problems. Despite the extensive resources that exist in the U.S. today and the growing response capability in this country, certain key problems and difficulties persist. While many of the situational circumstances or impact contingencies associated with a chemically induced disaster event cannot be altered through the efforts of community officials, several socio-behavioral factors can be manipulated through preparedness programs so that overall community response capability can be improved.

Some of the more important and germane issues and factors implied in the previous discussion are noted below. Communication linkages and coordination between local emergency officials and representatives from the chemical industry must be improved in order for these parties to effectively and mutually mitigate potentially catastrophic chemical disasters. Problems related to the initial response must be resolved since activities which occur during the first few moments of a dangerous chemical incident can determine if the overall response will be successful or ineffectual in the timely neutralization of the threat. Training and education in areas of identification of the nature of chemical threats, notification of relevant responders, procedures for stabilization and neutralization, and methods of obtaining specialized resources can greatly improve initial response capabilities. Generally, coordination at the community level must be improved through a clearer allocation of emergency response leadership and authority, as well as by an overall effort to coordinate task responsibilities. Evacuation related problems can be minimized through the provision of complete

and accurate information and instruction. Furthermore, local officials must identify methods of keeping evacuees informed of developments throughout the duration of the incident as well as provide official recall information. Finally, the need for readily available medical information concerning the symptoms of chemical exposure and the subsequent treatment of victims must be addressed and fulfilled by health sector personnel, disaster planners and policy-makers.

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