PREFACE

> "Experiences gained in combating hazardous materials incidents have not yet been adequately collected, analyzed, and incorporated into training materials."

The above quotation from a 1978 congressional investigation of emergency responses to hazardous materials transportation accidents illustrates a major reason why the following primer was written. This volume pulls together some of the implications of a major, systematic study of community disaster preparedness planning, especially for acute chemical emergencies, undertaken by the Disaster Research Center (DRC). From considerable field data collected from a variety of local emergency groups, an analysis was made of the factors which seemed to be involved in preparing adequately for hazardous materials incidents. In this work, DRC is attempting to indicate some of the more important things which should go into community planning, thinking and trairing for possible chemical disasters.

The existence of a problem area seems indisputable. The 148 billion dollars-a-year chemical industry manufactures tens of thousands of different chemicals annually, with more than 20,000 of them produced in amounts exceeding one million pounds yearly. While a large majority of chemicals are not normally dangerous, the sheer volume of the industry means that the production and storage of dangerous chemicals increases every day. Several hundred new dangerous chemical products are also produced every year and moved, stored and used around the country.

The transportation of hazardous chemicals occurs on a very large scale and increases in volume every year. There is reason to think that actual and potential in-transit accidents are also increasing. In 1978, it was estimated that more than four billion tons of hazardous materials were shipped 218,710 million ton-miles by various transportation modes in the United States. About 35 percent of all freight trains contain hazardous materials. While no exact statistics of yearly increases in daily shipment exist, neither logic nor general knowledge of the chemical and the transportation industries would suggest any stabilization or decrease in the movement, storage and usage of dangerous chemicals.

Department of Transportation records, which are known to be incomplete, show that from 1977 to 1978 there was a 19 percent increase in hazardous materials incidents' reports. The highest figure ever of 18,022 incidents, undoubtedly partly reflects better reporting mechanisms, but the fact is that these are minimum figures at best. The DRC study suggests underreporting of incidents, especially of truck accidents involving dangerous chemicals. Yet, in the reported figures for 1977, there were 13,250 hazardous materials incidents in highway accidents compared with around 1,500 in railroad accidents. In the

first six months of 1978 alone, 269 train derailments involving hazardous materials and 281 other hazardous materials accidents were serious enough to involve state disaster emergency offices. The latter figures only hint at the emergencies which occur in nontransportation settings, in fixed facilities where dangerous chemicals are manufactured, stored and used for various industrial purposes.

It is true, most acute chemical emergencies do not eventuate in severe manifest losses, although as noted in the text, even a threat can be disruptive and costly in many ways apart from death and injury or even property damage. In addition, there have been numerous major chemical emergencies, where the deaths and injuries over the years aggregate in the hundreds and thousands and property damage in the millions. Finally, the potential for a massive catastrophe is always present, and possibly because of an increasing number of things which can go wrong, may be more probable in the future than it ever was in the past.

The absence of catastrophes and the relatively small number of major chemical disasters in the United States thus far could be attributed to good safety measures--and they may be better than many other places in the world--but studies of incidents suggest too many "near misses" and lucky combinations of circumstances to attribute too much to technical safeguards. Field observations and studies of preparations for and organized responses to acute chemical emergencies also, frequently document confusion, uncertainty, lack of coordination and general inefficiency in the mobilization of resources when confronted with a sudden chemical threat. The picture one frequently gets is similar, although on a smaller scale, to that depicted by the Presidential Commission on the Three Mile Island nuclear accident, that is, the technological safeguard proved relatively adequate, but the human errors and organizational flaws were such as to almost turn a rather routine accident into an incredibly disastrous catastrophe. Many small scale dangerous chemical incidents are frequently transformed into potentially larger and more serious events by inept efforts at initial response.

This primer focuses on the human and social side of acute chemical emergencies. There are a number of handbooks and guides which deal with the technical side of hazardous materials incidents. There are none that deal primarily with the group factors in the preparations for responding to such events. In fact, to our knowledge, this is the only publication in the area, which views the problem from the perspective of the local community, i.e., the emergency organizations in a locality that have to think about and undertake disaster preparedness.

In the pages that follow there is no attempt to prescribe details. Instead, principles of planning for responding to acute chemical emergencies are stressed. This volume is, therefore, not a manual; it is a primer in the old-fashion sense of an educational primer. A primer provides general guidelines, indicates what is important and has to be taken into account and tries to show how the parts or pieces of something relate to a larger whole. This primer stresses the principles of

disaster preparedness, suggests what social factors must be taken into account in the process of planning and argues that preparedness for acute chemical emergencies is, to a considerable extent, an extension of planning for any kind of serious community mass emergency. As such, this work is more for planners and key decision-makers in emergency organizations, than it is for first responders from those organizations to hazardous incidents.

In setting forth its recommendations, this volume leans very heavily on that part of DRC field work which focused on chemical disaster preparedness in communities around the United States. Since this is not a research report primarily aimed at other researchers, but an educational product for planning and training use by disaster planners and decision-makers in the acute chemical hazards area, specific documentation to the field data has been downplayed. Specific research results from this study are reported in other DRC publications. Certain literature references to specific sources are cited in the text. However, in the main, the literature used for this publication is generally listed at the back of the volume, rather than specifically cited in the text. For those interested in more in-depth study into the question and issues raised in this work, a brief annotated bibliography is also appended.

There is also a later companion volume to this one which deals not with preparedness but actual response to acute chemical emergencies. Obviously, there is a connection between preparedness and response. But, if disaster preparedness is adequately done, there will be fewer problems in response and a need to adjust to the immediacies of the situation. Community and organizational officials, who include in their planning, practices and training the ideas expressed in this preparedness primer, should be implementing in their actual responses to an acute chemical emergency those measures the other volume on response will be advocating for those who have not undertaken the appropriate disaster preparedness.

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The three year Disaster Research Center study entitled, "Socio-Behavioral Responses to Chemical Hazards" funded by the National Science Foundation, is a groundbreaking research effort. The study employs a social scientific approach in an attempt to add to our understanding of how to live with a new development in our society--the rapid increase in our reliance on chemicals, some of which are hazardous--in many aspects of our lives. The rationale for the study is straightforward. It begins with the assumption that all social endeavors--including those sometimes considered purely technological problems--have a human dimension. A second assumption is that, since technological problems are often basically "people" problems, they can more easily be ameliorated if seen from a perspective informed by an understanding of principles of individual, group, and organizational behavior. The study thus focuses on ways in which social factors operate at all stages in the handling of hazardous chemicals. The objective is to contribute to more efficient and effective planning for and management of chemical emergencies.

This primer is one in a series of reports stemming from the study. Like the products of this and other large scale research projects, the primer is a team effort in all respects and at all stages. Professor E. L. Quarantelli, Principal Investigator, is the person who first recognized the significance of the research topic. He provided the initial impetus for the study and later took responsibility for the overall design and conduct of the research. Professor Verta A. Taylor was co-Principal Investigator during the all-important early months of the project.

The day-to-day work of the project was carried out by a multidisciplinary team of advanced graduate students from the fields of sociology, organizational behavior, political science, public administration, and urban planning. In most cases, these individuals were "triple-threat" types, i.e., they were skilled in data gathering, data analysis (including computer applications), and report writing. The people who performed the major share of the data collection and analysis tasks during the first year of the study, on which this primer is based, are Clark Lawrence, Project Manager, 1977-78; and Research Associate/Field Workers, Sue Blanshan, John Bolland, Cheryl Miller. Shari Carres, Thomas Gabor, Terri K. Griffith, Lauri Dagher, Quinten T. Johnson (who later became project manager for Phase II of the study), and Robert G. Swisher. These team members were later joined by Jane K. Gray, John Helms, Lori Minutilli, and Todd Peterson, who not only performed ably as field workers, but also took major responsibility for all aspects of data storage, retrieval, and analysis. Their contributions, like those of the individuals named above, are reflected in this report.

In the production of this primer and the other project reports as well, all our efforts would have gone for naught, were it not for the incalculable contributions of Elizabeth Wilson, the Center's Executive Director, whose editing expertise takes jargon and makes it sound like English. Finally, thanks are due to Shari Carres, Andi Ceisler, and Charlsa Norman for preparing the final manuscript.

Special thanks must also be given to persons from outside the Center. In every way that counts, William A. Anderson, of the National Science Foundation is the kind of research liaison officer every project wishes for: an outstanding social scientist and researcher possessing an in-depth knowledge of many aspects of the substantive area being studied. The project

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Finally, all those officials and citizens who provided information and otherwise assisted and cooperated with the Center's field workers must likewise be thanked.

Any faults, shortcomings, and errors in this report are, of course, the responsibility of the author, who had the privilege of serving as Field Director on the project during the period 1977-1979.

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