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Preface

Learning from international responses to hazardous materials

1. Introduction

It has long been known that hazardous materials are ubiquitous in the world. Certainly, in industrialized societies the presence of dangerous substances is needed to create the elements that distinguish modern life: electrical power, industrial capacity, and the like. Indeed, all modern economies are involved to differing extents in the transportation, storage, and use of hazardous chemicals. Thus, we find hazardous materials “repositories” located literally throughout nations, some taking the form of large and small manufacturing businesses, while others — less often thought of as hazards due to their integration into our lives — take the form of gasoline stations, dry cleaning establishments, hardware stores, hospitals and grocery stores. Rural areas are affected since in many countries these areas are chosen for locating large “noxious” facilities such as power generating plants, and ground transportation of hazardous chemicals between urban areas must pass through rural areas. In fact, the transport issue extends the presence of hazardous materials from the ground to both the air and the sea.

Furthermore, it is not just industrialized nations that concentrate hazardous materials. Developing countries harbor points of extraction for resources that are used both in the developing countries and the industrialized world, and extraction technology is a heavy consumer of hazardous materials. In addition, developing countries — in striving to incorporate modern technology into the lives of their citizens — utilize, transport and store hazardous substances for their own use and sometimes serve as home to chemical manufacturing firms whose products are exported to industrial nations. With their generally less stringent environmental protection standards, some developing countries also serve as repositories or dumps for hazardous wastes moved from industrialized nations.

In short, hazardous materials flow through the world — all parts of it — and define much of modern life by providing the benefits that accrue from such materials themselves and the technologies and products they support. However, the other side of the coin exists, and this deals with the negative consequences of unplanned and unmanaged releases of hazardous materials into the environment. These consequences include, of course, the health

consequences of long- and short-term human exposure to the materials themselves. There are myriad causes or routes that lead to environmental releases of hazardous materials. In addition to safety problems associated with the technology for transporting, storing and using hazardous substances, environmental releases sometimes flow from or are linked to natural hazards such as earthquakes, tornadoes, floods or hurricanes [1].

Thus, as long as we harbor technology, to a large extent hazardous materials “disasters” are inescapable [2,3]. In fact, the record of recent decades demonstrates that such disasters broadly impact the entire world. To mention only a few very large incidents, these include Bhopal in the developing world [4], Three Mile Island in the United States [5,18], the Chernobyl accident in the former Soviet Union [6,7], and Canada’s Mississauga chlorine gas emergency [8]. Literally thousands of smaller incidents have been documented and studied in the literature on social management of hazardous materials events across the world [9–13].

Because the world is ever-dependent upon the benefits of technologies and the hazardous substances themselves, humans cannot eliminate them and consequently eliminate the risks [3,14]. Instead, we have adopted two general strategies for reducing the risks associated with hazardous materials: using technology to enhance safety and reduce the probability of environmental exposures (mitigation), and enhancing our ability to minimize the negative consequences that accrue when a release does occur (preparedness and response).

It is this latter issue of emergency management that is of concern in the collection of papers presented in this special issue. The goal of assembling the special issue has been to bring together contributions from a variety of nations to share perspectives on managing the consequences of hazardous materials incidents. In doing so, it is the hope of the editors to promote exchanges of knowledge and encourage the adoption of an international perspective in the emergency management of technological threats and disasters. This seems especially important and timely given that in spite of the world-wide impact of hazardous materials accidents, there has been only a limited dialogue among emergency managers across nations regarding the handling of such events. This issue presents six papers; three of them address the complexities of national efforts to address hazardous materials threats and three examine specific case experiences in different countries.

2. National scope studies

Boris Porfiriev’s paper focuses upon the institutional and legislative side of creating a national emergency management policy in Russia. The detailed history he presents is particularly important because the genesis of emergency management policy in Russia, and in many other developed countries of the world, lies in the legislation and organizational structures developed for civil defense and military functions. Thus, almost all international efforts at national emergency management policy are “pasted on” a framework of old laws designed for military purposes and only incrementally modified to address the more civilian events such as natural and technological disasters. To the extent that the “fit” between military-oriented needs and organizational structures and the needs associated with disaster management is poor, the response to these latter events sometimes suffers [14,15]. It is through the legislative process and the accompanying institutional arrangements that

national policy is made and changed in ways that increase the probability that policy mandates will enhance the likelihood that response operations at disaster events themselves will be effectively managed.

Much of the paper is devoted to illuminating the milestones (both victories and less successful developments) in Russia's attempts to develop a coherent national policy for emergency management. These milestones form an important guide to those in other countries as they follow paths for the growth of a national policy. As Porfiriev indicates, there are many parallels in disaster policy development among Russia, England and the United States; not just the beginning in civil defense policy, but the tendency of governments to build future policy piecemeal on the experience of past disaster events. In particular, Porfiriev addresses the complexity of legislative mandates, the impact of administrative and institutional arrangements for implementation, the role of prevailing political and economic environments, and the exigencies associated with the need for "up front" funding of mitigation and preparedness versus the tactic of funding "recovery" after the fact. Indeed, the discussion of the Russian experience of moving toward an "all hazards, all phases" emergency management approach will inform and educate the process in the rest of the world.

In a similar vein, the second paper by Lindell and Perry addresses the success of a single body of legislation in the United States to deal with hazardous materials management. In particular, these authors review the implementation of Title III of the Superfund Amendments and Reauthorization Act (SARA Title III), which sought to reduce the threat of toxic chemical accidents. The principal manifestation of this legislation was to require States and communities to create organizations whose responsibility is to collect, evaluate and create emergency plans based on the types and quantities of extremely hazardous substances produced, used or stored by industrial concerns. Lindell and Perry review the history of this legislation, the initiatives taken by both critics and supporters, and then assemble and interpret the results of a number of studies of the impact of the legislation.

Based on an examination of more than 30 studies and industry and government statistics, the authors conclude that for the most part, the implementation of SARA Title III reached its five primary mandates. Consequently, Lindell and Perry argue that private industry has disclosed hazardous chemical inventories, that State and local emergency planning organizations (called committees) have been created, that the membership of the committees does include a variety of constituencies, emergency plans have been prepared at both State and local levels, and that at least some public access has been created to hazard data. It was also found that there SARA Title III is linked to an increase in technical guidance training and materials from the federal government, but that the task of calculating vulnerability zones in local communities based on technical information was proceeding slowly. The expectation of critics that conflict would emerge between owners and operators of hazardous chemical facilities and surrounding communities has not been borne out.

Indeed, the efforts of industry associations and some local plants to disseminate information about chemical hazards seems to have reduced conflict in communities. On the other hand, while information is more available to community members, SARA Title III does not appear to have public dialogue about chemical hazards to any noticeable extent. In part this may be attributed to laxity on the part of local emergency planning committees to advertise their presence and activities in the communities. Lindell and Perry close their

paper with a discussion of measures that might be taken to further enhance the impact of SARA Title III legislation and to build the strengths of State and local emergency planning efforts.

Finally, Helene Denis examines the management of hazardous materials disasters in Canada. Her work begins by examining the Canadian Disaster Management System, both in terms of legislative mandates and the organizational arrangements created for responding to events. From this conceptual base, she reviews four cases of hazardous materials accidents in Quebec: a PCB warehouse fire in St-Basile-le-Grand, a fire in a tire dump in St-Amable, a train derailment in Charny involving sodium hydroxide and chlorine, and a second derailment involving propane near Lennoxville. Based upon these case experiences, Denis extracts a conceptual framework for understanding emergency response that includes technological and socio-political factors and their relationship to complexity and uncertainty in managing the disasters. By distinguishing types of uncertainty and complexity, she is able to identify specific response problems that inherently flow from needs to move citizens to safer places (evacuation), public health impacts of toxic materials, and leadership needs associated with the management of the emergency.

In particular, she identifies a variety of demands that especially important in the management of disasters involving toxic chemicals. These include the importance of communication among technical experts and emergency responders, conduct of direct assessments and dissemination of information on health risks, the need to link the public with expert information quickly and continuously, and the establishment and dissemination of a clear designation of responsibility among emergency responders. Further, Denis describes the factors that contribute to the politicalization of hazardous materials disasters and paths to the development of trust and acceptance of the authorities by affected citizens.

3. Event case studies

The special issue concludes with three papers that represent case studies of events involving toxic materials. Arjen Boin, Menno van Duin and Liesbet Heyse studied the management of the events associated with the crash of an Israeli cargo plane into a suburb of Amsterdam (Bijlmermeer). Their work is many-faceted, but concentrates on the longer-term management of the event and the consequences, in particular, of the communication practices used by authorities. In spite of 43 deaths in the event, the author's acknowledge that the immediate response by authorities was effective and well orchestrated. Difficulties arose, however, in managing what Boin and his colleagues call the "disaster after the disaster"; referring to the period of time after the immediate response needs were managed.

The case reveals that the cargo of the plane and its toxicity was not readily determined and consequently, information regarding exposure dangers were not available for either the public or emergency responders. Through rumor and other information processes, the event became politicalized, there were psychophysiological reactions among citizens, and litigation arose. All of these forces shaped the ultimate impact of the crash event, and the authors effectively identify opportunities missed by the authorities to counter negative

outcomes. It is important that this case replicates knowledge derived from research on natural disasters and radiological accidents: particularly that lack of information can create fear responses that both create unnecessary psychological suffering and psychophysiological symptoms. It is of equal importance that the author's isolate processes that appear common to hazardous chemical events; namely the tendency to politicize the issues and to involve litigation for remedy of harm.

Boin and colleagues identify a variety of mechanisms and issues that may facilitate emergency management of the longer term aftermath. First, they caution against focusing upon "termination" of the event; this can lead to premature closure and inadequate investigation and evaluation of the event and associated threats. Second, they emphasize that an effective communication and information system must be devised and should not only link the public, emergency responders and technical experts, but also other government authorities and the mass media. Finally, authorities need to form contacts and linkages community self-help organizations to facilitate their involvement in response and recovery plans.

The second case study by Castenfors and Svedin reviews the threats associated with the transportation of hazardous chemicals in general and particularly with a tank car leaking liquified propane gas near Stockholm. While the thrust of the paper focuses upon communications, the authors begin with an important assessment of urban settings as foci for hazardous materials threats. They demonstrate that urban areas tend to be centers for hazardous materials storage, use and transportation and that the associated high population densities, restricted space, variable resistance of buildings (urban decay), and coupling or "bunching" of life lines (power, sewer, water, etc.) constitute an especially dangerous environment. They also argue that political and legislative attempts to reduce the hazardousness of urban areas have been severely limited in success owing to economic conditions. It is interesting that similar observations of the special vulnerability of urban areas to hazardous materials have also been made in a variety of other countries [16,17].

The conclusions from the study emphasize both recognition and understanding of the role of mass media in emergency management and differing types of communication. In connection with the latter issue, the authors conceptualize modes of crisis communication into three types, based on the perspective of the speaker: the sender perspective, the volume perspective and the dialogue perspective. In their conclusions, Castenfors and Svedin describe the capacities of each mode and the conditions under which each serves specific emergency management functions.

The final paper in this issue is a report from Crichton and Flin on the explosion and fire at a Texaco refinery (Milford Haven) in Wales. In the course of their case study, the authors document the high levels of work stress and demands for effective performance of duties in a compressed time period that characterized the accident. Furthermore, they discovered that while emergency responders had experienced much training on the technical side of their work, the non-technical side — including skills related to decision-making, situation awareness, stress management, and communication — was less often the subject of training. The result during the accident was some delay, lack of coordination of response, and varying levels of teamwork that potentially threatened the effectiveness of the response to the emergency. Based upon these conclusions, the authors conclude that

attention needs to be given to developing these non-technical skills as part of emergency preparedness. In particular, they developed a training mechanism called “tactical decision games” that places participants in a simulated real disaster environment and emphasizes the development of decision-making, assessment, and teamwork skills. Because of its adaptability to virtually any hazard or any cultural or national system, the decision game training mechanism represents a significant contribution to hazardous materials emergency preparedness.

4. Conclusions

The path to real international dialogue and cooperation on the management of hazardous materials will undoubtedly be a long one. Especially, if we use as our measure the time it has taken to establish even small dialogues on natural disasters. We see this special issue as at least a small initial step; one opportunity to display and share the findings of researchers from six countries. We were struck by the parallels among different countries that are revealed here. The legislative and administrative experiences in Russia are also being faced in the United States and Canada, and will be faced in other countries as well. Citizen fears and reticence over toxic chemicals and their management are also international. The struggle to train emergency responders and the hazardousness of urban areas are likewise not confined to any national entity.

It is our hope that the dialogue begun here will become an international dialogue and will continue, and in so doing that the ability of authorities internationally to manage hazardous materials disasters will be enhanced.

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