Environmental Management and Disasters: Contributions of the Discipline to the Profession and Practice of Emergency Management

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Abstract

This chapter explores the contributions that environmental management can make to the theory and practice of emergency management. It first examines environmental management as a distinct field of practice and draws parallels in the diversity of academic backgrounds and routes of entry common to both fields. A brief history of the environmental movement in the US is followed by a discussion of the concept of "disaster" in the context of environmental management and emergency management, and an acknowledgement of the significance of environmental degradation as a contributing factor in disaster effects. The chapter notes the domestic and international regulatory imperative that embeds emergency management solidly in the practice of environmental management, and it concludes by identifying areas where environmental management and emergency management can and should interact more positively for mutual benefit and support.

Introduction

The disciplines of environmental management and emergency management share many of the same concepts, issues, processes, and concerns. Yet they come into contact only rarely, and then usually it is only a glancing blow. Parts of environmental management include risk assessment, hazard identification, spill response, and emergency/contingency planning – all activities that are central to the practice of emergency management. Other parts of the field address such issues as water quality, protection of flora and fauna, and general health of the ecosystem – all of which may be affected by decisions and actions taken in the pursuit of emergency management.

The editor's original assignment for this chapter centered on Environmental Science but, like any good student, I have re-written the exam question just a bit. I found that focusing on

Environmental Science is a bit too restrictive and not sufficiently informative. Accordingly, I have modified the scope of the chapter to focus on Environmental Management, which includes Environmental Science, Environmental Engineering, Ecology, and related disciplines. This focus gives a more well-rounded view of the environmental field and its potential contributions to emergency management.

I have long been a practitioner in both fields. I have, therefore, approached the information, concepts, and arguments discovered in researching this chapter from the perspective of those in both fields who are confronted, on a daily basis, with the need to act and make decisions that have immediate practical effects. I have tried to focus on practical applications as opposed to policy formulation. Considering the spectrum of "environment" – small-scale waste management at one end, global warming and climate change at the other – this article focuses on the part from the mid-line (wherever that is) on down.

This chapter does not pretend to an exhaustive discussion of environmental issues, nor does it explore all of the current thinking and research in emergency management. Rather, it focuses on those areas where the two disciplines overlap and can interact to mutual benefit. It also does not trespass on other discrete fields such as safety, meteorology, public health, or law even though there are explicit interactions and interpenetrations between these fields and both environmental management and emergency management.

Understanding the terms

Environmental management is somewhat of a portmanteau term that comprises many of the more academically accepted disciplines. It brings together elements of science, engineering, policy, assessment, and auditing, as well as basic down-in-the dirt/air/water analysis and action. At one end of the spectrum lies the realm of environmental policy and regulation; at the other end lies what has been described as “blue-collar science.” Here is a quick definitional tour:

- Ecology – a consensus definition on the web is “The study of the relationships between living organisms and their environment.”

- Environmental Science “comprises those disciplines, or parts of them, that consider the physical, chemical and biological aspects of the environment. … it transcends disciplinary boundaries and is concerned with the interactions among processes each of which is best described by a particular discipline. It is the study of natural cycles and systems and their components" (Allaby 1996).

- Environmental Engineering is the application of science and engineering principles to improve the environment, to provide healthful water, air and land for human habitation and other organisms, and to enhance the remediation of polluted sites.

- Environmental Management is the planning and implementation of actions geared to improve the quality of the human environment. It is public and private organizations

actively dealing with environmental issues on a daily basis.

The boundaries among these fields are neither straight nor rigid, and they permit migration to and from a number of other disciplines – consider "environmental health" or "environmental toxicology."

One can come to a career in environmental management from many directions. In preparing this chapter, I took an informal poll of 38 co-workers and colleagues (in both public and private sectors) who are active in some aspect of the environmental management field. I asked for their academic experience (degree and major; advanced degrees). I was expecting a broad range of backgrounds, and I was not disappointed. Though I make no claim to statistical rigor, the following chart shows the considerable variation in academic backgrounds among the respondents.

Environmental Management Academic Background

Degree	Undergraduate Major	
N = 38	Engineering ▪ Civil – 1	History/Humanities/ Liberal Arts – 3
BS – 23 (1 person has 2)	▪ Chemical – 1	Other (1 each)
	▪ Mechanical – 1	▪ Business
BA – 14	▪ Environmental – 1	▪ Hotel Management
		▪ Nat. Resources Mgmt.
B Phil – 1	Environmental	▪ Forestry
	▪ Science – 3	▪ Anthropology
AA/Cert. – 1	▪ Studies – 2	▪ Education
		▪ Env. Administration
MS – 8	Biology – 4	▪ Mathematics
		▪ Planning
MA/MPA – 5	Fisheries – 2	▪ Agricultural Technology and Management
JD/PhD – 4	Geology – 3	▪ Marine Science
		▪ Environmental Health
	Chemistry – 4	▪ Physics
		▪ Political Science

The BS degree predominates but not overwhelmingly so. Environmental Science/Studies represent but a fraction of the academic majors represented. The "other" category is all over the map. Graduate study is equally varied: Engineering, Forest Science, Biopsychology, Environmental Management/Natural Resources, Psychology, History, and Law – to name a few. The point here is that there are many roads into the practice of environmental management, just as the field itself covers a wide variety of disciplines, activities, and sub-specialties. I imagine that a similar survey of practitioners in the emergency management field would show a similar variability in backgrounds.

Brief history of the environmental movement

The Environmental Movement (or "Environmentalism," another popular term) is a relative youngster, of uncertain parentage. Some of its roots lie in the ethics of conservation and preservation that arose in the late 19th and early 20th centuries. With the closing of the American frontier came the desire to protect the "wild lands" on the one hand and, on the other, to produce as much as possible without spoiling the land. Preservation and "right use" were the prevailing ideas regarding the land and water. Wilderness protection in the 1920s and 30s was aimed at "setting nature apart" as a national repository of aesthetic, ecological, recreational, and regenerative riches for the benefit of urban citizens (Gottlieb 1993).

On the other side of the family lie efforts through the 1920's to address the human health and environmental hazards of the increasingly urban/industrial life of many Americans. Alice Hamilton, Professor of Industrial Medicine at Harvard, published *Industrial Poisons in the*

United States (1920), detailing the hazards affecting industrial workers and urban residents. The public health profession after WWI began to attack such problems in the cities as contaminated water supplies, poor waste collection/disposal systems, and air pollution. Labor unions also promoted reform through environmental advocacy for and by workers.

The unrestrained urbanization and industrialization after WWII brought with it more discretionary income, more leisure (due to automation, labor saving devices, etc.), increased automobile ownership and use – leading in part to more travel and a greater appreciation of environmental surroundings and amenities. At the same time, the growth of suburbia and the proliferation of affordable housing led to more intensive use of land and resources. Construction of wastewater treatment plants did not keep up with population growth and density, with the result that raw sewage flowed into streams and lakes, causing pollution and eutrophication and the death of aquatic wildlife. More consumption created more municipal waste that was disposed of in landfills, open dumps, or incinerators with no pollution control equipment[1].

A number of disparate ideas, trends, and discontents came together in the late 60s and early 70s to create (among other things) what we know as the modern Environmental Movement in the United States. Rachel Carson's *Silent Spring* had sensitized people to corporate and governmental lack of concern over the effects of pesticides on humans, birds, and animals. Pollution of land, air, and water were becoming increasingly obvious – including such spectacles as the Cuyahoga River catching fire, the Santa Barbara oil spill, to name a few (Speth 2004, p. 82-83). At the same time, New Left critiques of political ideas and concepts, philosophies and the dubious fruits of technological progress (not to mention anti-war, anti-government protests)

provided a matrix for environmental consciousness and action: "…for many in and around the New Left, environmentalism came to be associated with the search for alternative institutions and a new way of life" (Gottlieb 1993, p. 97).

The passage of the National Environmental Policy Act in 1969 and the celebration of Earth Day around the nation in 1970 (surpassing the organizers' expectations in the extent and enthusiasm of participation[2]) engendered both a significant body of legislative and regulatory action on environmental matters and an explosion of popular enthusiasm, interest, and activity for environmental protection and quality.

> In just four years, between 1970 and 1974, an extraordinary range of legislative initiatives, regulatory activities, and court action came to the fore. These established a broad and expansive environmental policy system centered around efforts to control the environmental by-products of the urban and industrial order. Through this system, a vast pollution control, or environmental protection industry was created, including engineering companies, law firms, waste management operations, and consulting firms specializing in environmental review, standard setting, or other new environmental procedures (Gottlieb 1993, p.125).

This environmental protection industry, along with the growth of technical expertise within regulatory agencies, placed the environmental quality debate on a more scientific, technically-based foundation from which to confront the full range of environmental problems facing

[1] Flippen, J. B., "Richard Nixon and the Triumph of Environmentalism." in Warren 2003, pp. 272-289

society. The growth of new environmental expertise and technical competence, emphasizing technical solutions, has largely focused on "end-of-pipe" solutions (i.e., dealing with the problems after they have already been created). Some laws do have a pollution prevention focus, but most efforts, until fairly recently, have concentrated on dealing with the waste already created.

Efforts by the Reagan Administration to roll back environmental regulation were met with a revitalized effort by environmental organizations, citizens' groups, victims of pollution effects, and academics to ensure that the gains of the 70s would not disappear. Though progress had been made in some areas (e.g., urban air quality), enhanced attention to and more rigorous investigation of environmental contamination had discovered even more – and more threatening – problems (Dunlap 1992, p. 5). The proliferation of grassroots environmental movements in 1990s brought together a broad cross-section of class, occupational, and income groups pursuing local action against toxic industrial and disposal sites, landfills, and treatment plants. This has grown into a concerted focus on environmental justice/equity, environmental quality as an issue of civil rights, gender, ethnicity, and empowerment.

Global environmentalism has proceeded along much the same route, although perhaps not as soon or as quickly. Significant events during the 1980s (Bhopal, Sandoz, Chernobyl, Exxon Valdez) got public attention and influenced governments to increase their rhetoric, if not immediate action. Popular protest eventually created an agenda item for international affairs, and the status of the environment became an object of political action and legal prescription. More

[2] A number of accounts have estimated that 20 million participated across the country, in addition to 2,000 colleges and universities. See Flippen.

recently, governments and NGOs have focused on sustainable development and the deleterious effects of environmental degradation (Dunlap 1992).

An important, though still quite controversial, development within the environmental community is the "Precautionary Principle", which assigns the burden of proof to those who want to introduce a new technology, particularly in cases where there is little or no established need or benefit and where the hazards are serious and irreversible. Growing out of European environmental policies in the late 1970s, the Precautionary Principle notes a potential environmental or human health hazard, emphasizes the scientific uncertainty that exists regarding the possible result, and therefore asserts the need for preventive, precautionary action as opposed to immediate implementation.[3] Though popular in Europe, the Principle is criticized by many as limiting technological progress, hindering the introduction of new products (e.g., genetically-modified crops), and generally contributing to an anti-business bias (Foster, Vecchia, and Repacholi 2000).

To return to the focus of this chapter, one can draw parallels between the growth and development of the environmental management profession and that of emergency management. Civil defense became disaster preparedness, which became all-hazards preparedness, which grew into emergency management with an increasing focus on mitigation (prevention/reduction) as opposed to response and recovery ("end-of-pipe"). Considerable research into human response to disasters, effective planning concepts, and information management and communications has provided a technical foundation for the practice of emergency management. Practitioners have

[3] "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause-and-effect relationships are not fully established scientifically." *from the January 1998 Wingspread Statement on the Precautionary Principle.*

shed the "helmet and armband", "retired military" image and have taken advantage of increasing opportunities for formal education, with a discrete body of knowledge, and certification in the field.

"Environmental" in the disaster context

The environment is often seen as the agent/cause of a disaster or perhaps as the carrier. In an earthquake or a flood, for example, the "environment" behaves in ways that bring harm to the communities affected by them – one suddenly finds the environment sitting in one's living room. However, people make choices – farming practices, use and procurement of fuels, selection of building materials and sites, etc. – that significantly affect their vulnerability to environmental disasters (Aptekar 1994; May, et. al. 1996). This view mirrors the idea that disaster is a social construct formed by the interaction of human development with natural processes. An earthquake is a disaster only when it impacts the human infrastructure (Mileti 1999; Cutter 2001; Burton 1993; Varley 1994).

But the environment also interacts with human society in complex ways. Floods may damage natural habitats and ecosystems; forest fires may harm forest ecosystems and damage the biotic stock in an area. Yet, floods are necessary to renew and enrich riparian corridors and wetlands and to recharge aquifers; forest fires thin out undergrowth that could fuel larger fires, and they can re-vitalize biodiversity (Sauri 2004). Floods can clog wastewater treatment plants, causing the release of untreated sewage into water bodies; floods can also mobilize contaminants and industrial chemicals that then flow downstream and possibly into those same aquifers.

Thus, an "environmental" hazard may be difficult to define, and there can be a fine distinction between an environmental hazard (i.e., water out of control – a flood) and an environmental resource (i.e., water in control – a reservoir). It can often be a matter of perception regarding deviations about the norm – too much rain is a flood; too little is a drought (Smith 1996, p. 11). Some definitions of environmental hazard emphasize the acute and short-term at the expense of the chronic and long-term (droughts desertification, erosion), for example:

> …extreme geophysical events, biological processes and major technological accidents, characterized by concentrated releases of energy or materials, which pose a largely unexpected threat to human life and can cause significant damage to goods and the environment (Smith 1996, p. 16).

There is a growing understanding of environmental degradation as a contributing factor in disaster effects – i.e., an exacerbating factor in damage, it worsens impact on victims and makes recovery more difficult. One example:

> Although the largest danger facing Turkish urban areas is earthquake, numerous other hazards exist. Improper handling of solid wastes causes explosive methane build-up, endangers the physical environment, reduces property values and destroys the scenic and tourist values of highly visited areas…. Near the larger cities, many bodies of water are so polluted that they are no longer suitable for recreational use. High levels of heavy metals are found in harbor catches, and massive fish kills are common. Marine accidents

> release massive, toxic discharges, sometimes causing explosions that destroy buildings and facilities. Dangerous chemicals enter the urban food chain…urban rivers are polluted…agricultural chemicals and waste water have contaminated precious aquifers… (Parker, Kreimer, and Munasinghe 1995, p.13).

The most recent example occurred in the South Asian tsunami – long-term damage to coral reefs and degradation of mangrove swamps in some areas reduced the capacity of natural systems to absorb or cushion the kinetic energy of the tsunami surge.

Deleterious effects of degraded environmental conditions are felt most keenly (though not exclusively) by the poor, residents of shantytowns, "favelas," and other marginal or hazardous areas. They are clustered on steep slopes subject to flash floods and erosion, in dwellings built of substandard materials, with poor water and waste disposal systems. Natural disaster effects can be greatly magnified by the poor environment in which these people live.

According to Pelling (2003b), there is a tendency to focus on technical and engineering issues in addressing environmental problems or issues and to discount the influence of social characteristics on susceptibility to environmental risk. This bias toward technological and physical solutions (e.g., flood walls, or leachate mitigation systems) can encourage development in hazard areas when, in fact, hazards can surpass the margin of safety provided by technological solutions.

“Disaster” in the environmental context

The field of emergency management tends to focus more on harm to the human environment and the built environment and to pay less attention to the larger environment in which humans and structures exist. Also, the emphasis is on the more acute disasters (like earthquakes or chemical spills) and less on the slow-developing problems with chronic effects (e.g., Minamata or acid rain) or on acute events with long-lasting consequences (e.g., Bhopal, or the Tisza River). This no doubt reflects the understandable orientation of emergency management professionals to the needs of planning for and response to the immediate effects of a disaster and the desire for speedy restoration to something approaching the *status quo ante*.

Environmental professionals take a somewhat more comprehensive view, considering not only the human and built environments but also the matrix in which they exist. Environmental concerns include not only humans but also plants and animals, water and air quality, the fate and transport of environmental contaminants, the toxicology of human and animal effects, and the exposure and vulnerability (both acute and chronic) of the affected biota. All of these concerns can – and should – contribute in some way to the practice of emergency management before, during, and after disasters.

Consider the scope of environmental hazards/disasters:

Acute	Chronic
✓ Floods ✓ Oil spills on water bodies ✓ Hazardous materials spills (to soil) ✓ Hazardous materials spills (to water bodies) ✓ Landslides ✓ Containment failure (mine spoils, industrial wastes) ✓ Fish kills	✓ Sedimentation and siltation ✓ Air pollution ✓ Genetic mutation in indicator species ✓ Drought[4] ✓ Global warming ✓ Deforestation and flooding ✓ Loss of wetlands

Environmental management confronts all of these hazards, in one manner or another, and brings the full range of scientific, technical, and managerial skills and techniques to bear on preventing mitigating, or responding to their effects. Of course, the definitions of "emergency" and "disaster" are a bit different in the environmental field: "An environmental emergency is a tanker truck full of acid overturned and spilling in the middle of town. An environmental disaster is that same tanker spilling into a wetland or a river."[5]

Environmental hazards are not independent of other types of hazards, and one may lead to the other or make the other worse. For example, floods can degrade water quality, release chemicals and other contaminants from impoundments or containers (or even float off the containers themselves to lodge in someone else's backyard). Earthquakes can cause transportation spills, industrial chemical releases through infrastructure damage, or damage to containment. Destruction of the World Trade Center released asbestos, respiratory irritants, polycyclic

[4] Meteorological drought – a departure from anticipated mean rainfall. Hydrological drought –a reduction in available water relative to local demands. Agricultural drought – changes in timing, frequency or intensity of the rainfall that have specific implications for crop yield. (Dolcemascolo 2004, p. 16)

[5] Or another perspective: "An environmental disaster is the county deciding to build a wastewater treatment plant half a mile upwind from my house."

aromatic hydrocarbons (possible carcinogens), pulverized metals, and god-knows-what-else into the atmosphere, affecting rescue and recovery workers and undoubtedly contaminating the surrounding area (Mattei). As we have seen in the example from Turkey, above, environmental hazards may only be waiting for a triggering event to make a natural disaster even worse.

The Regulatory Imperative

Starting with the National Environmental Policy Act, 28 major environmental protection laws were enacted between 1969 and 1986. Environmental legislation since 1986 has generally focused on expanding or extending (and, in some cases, clarifying) existing laws. A number of these laws – and their implementing regulations – specifically address emergency planning and/or response in some way. These include:

- Resource Conservation and Recovery Act (RCRA, 1976) – Requires hazardous waste facilities to prepare and maintain emergency plans to prevent or respond to releases of hazardous wastes
- Comprehensive Environmental Response Compensation and Liability Act (CERCLA or "Superfund") – includes requirements for emergency plans during cleanup actions on uncontrolled waste sites
- Clean Water Act & Oil Pollution Act (1990) – requires Spill Prevention, Control, and Countermeasures plans be prepared by certain facilities storing petroleum fuels

- Emergency Planning & Community Right-to-Know Act (EPCRA or SARA Title III) – directed states and local governments to establish planning and coordination bodies to carry out emergency planning for chemical emergencies in their jurisdictions
- Clean Air Act, section 112r, Risk Management Program – requires certain industrial facilities to prepare an "off-site consequence analysis" for releases of certain chemicals and to prepare emergency plans in coordination with local response agencies
- Executive Order 12856 (1993) – directs Federal facilities to comply with EPCRA regarding public notification of chemical use and emergency planning

States have enacted their own set of environmental laws and regulations that parallel, enhance, and extend Federal regulations. In many cases (California and New Jersey are good examples), state regulations are more strict than Federal requirements.

An example of European regulatory action, affecting more than one country, is the Seveso Directive. A 1976 explosion at a chemical plant in a small town near Milan, Italy released a large cloud of dioxin that affected a large portion of Lombardy region. The explosion and aftermath, including the botched response, led to creation of the European Community's Seveso Directive in 1982.

A central part of the Directive is a requirement for public information about major industrial hazards and appropriate safety measures in the event of an accident. It is based on recognition that industrial workers and the general public need to know about hazards that

threaten them and about safety procedures. This is the first time that the principle of "need to know" has been enshrined in European Community legislation (Mitchell 1996, part 4).

Much of the Seveso Directive is analogous to EPCRA with additional elements addressing what are called, in the US, “worker Right-To-Know” laws. All of this happened several years prior to the Bhopal disaster, which was part of the impetus for passage of EPCRA in the United States.

Though not regulatory in nature, there are a number of international standards regarding environmental management that specify a requirement for emergency plans. The most widely recognized is the ISO 14001 standard for Environmental Management Systems, one element of which states, “The organization shall establish and maintain procedures to identify potential for and respond to accidents and emergency situations, and for preventing and mitigating the environmental impacts that may be associated with them” (ANSI/ISO 14004-1996, Section 4.4.7).

The objective of the *Guiding Principles for Chemical Accident Prevention, Preparedness and Response* (2003), published by the European Organisation for Economic Co-Operation and Development is to “provide guidance, applicable worldwide … to prevent accidents involving hazardous substances and to mitigate the adverse effects of accidents that do nevertheless occur.” This set of principles covers much the same ground as the EPCRA, the Risk Management program regulations, hazardous materials transportation regulations, and various environmental and safety standards in the US. Chapter 5 mandates emergency planning for protection of environmental media as well as for the protection of population.

The nexus of environmental management, development, and disaster risk

Considerable research and analysis has been done by the European Union and the United Nations to illuminate the connections among environmental hazards, sustainable development strategies (especially in the poorer countries), and disaster response and management. *Living with Risk* (2004), produced by the UN International Strategy for Disaster Reduction, puts it most succinctly:

> The environment and disasters are inherently linked. Environmental degradation affects natural processes, alters humanity's resource base and increases vulnerability. It exacerbates the impact of natural hazards, lessens overall resilience and challenges traditional coping strategies. Furthermore, effective and economical solutions to reduce risk can be overlooked…. Although the links between disaster reduction and environmental management are recognized, little research and policy work has been undertaken on the subject. The concept of using environmental tools for disaster reduction has not yet been widely applied by practitioners (p.298).

The UN International Strategy for Disaster Reduction also focuses on the transboundary nature of disasters and the importance of a "harmonized approach" to the management of pollution of river basins, seismic hazard areas, and volcanoes (*Disaster Reduction and Sustainable Development* 2003, p.13). This issue is perhaps less salient in the United States, due to the extent of Federal disaster management and response.

Researchers in the Swedish Embassy in Bangkok have sought to link environmental programs with disaster risk in the context of sustainable development. They ask:

- How can investments in environmental management and sustainable development also reduce disaster risk?
- Is there a *prevention dividend* [6] that accrues from wise land use planning and development programs?
- Can *prevention dividends* be measured; and, how might the ability to estimate these added values enhance policy and program planning? (Dolcemascolo 2004, p.1)

Although they find evidence for positive answers to these questions, they acknowledge that more research and analysis is necessary in order to capture the rather elusive cost/benefit parameters of disaster reduction and sustainable development.

Zones of convergence

Living with Risk (2004, p. 303) outlines ways to integrate environmental and disaster reduction strategies:

- assessment of environmental causes of hazards occurrence and vulnerability
- assessment of environmental actions that can reduce vulnerability
- assessment of the environmental consequences of disaster reduction actions

- consideration of environmental services in decision-making processes
- partnerships and regional approaches to land use and nature conservation
- reasonable alternatives to conflicts concerning alternative uses of resources
- advice and information to involve actors in enhancing the quality of the environment.

Within this context, there are a number of areas where environmental management and emergency management can and should interact more positively for mutual benefit and support.

Both fields would benefit from continuing and supporting the current movement in the disaster community from "reactive" disaster response to active risk management and from iterative recovery to pro-active mitigation and prevention. Parallel efforts would transition the environmental field from contaminant clean-up to risk reduction and pollution prevention, from discrete issues management to environmental management systems, and from flood control to floodplain management (see Philippi, 1996).

Integration of sustainability considerations into disaster mitigation and recovery can exploit the considerable overlap between environmental management and disaster management. Planners and practitioners in both fields must recognize that the overall objectives of these fields implicitly promote sustainable communities. Sustainability should be considered both prospectively (in sustainable development planning and mitigation) and retrospectively (in response and recovery). This integration would incorporate and enhance current trends toward "holistic disaster recovery" (also "sustainable recovery") that emphasize betterment of the entire

[6] "…*the values of foregone disaster losses that accrue from well designed and implemented disaster risk*

community, including environmental improvement and enhancement, through the recovery process (*Holistic Disaster Recovery* 2001). *Living with Risk* (2004) is even more direct:

> Disaster reduction specialists should be encouraged to anticipate environmental requirements under applicable laws and to design projects that address these requirements, coordinating closely with environmental institutions (p. 302).

Environmental management professionals can make considerable contributions during the mitigation and recovery phases of emergency management. They can identify possible improvements and enhancements as well as things to avoid. More importantly, after enhancements or improvements are in place, they can monitor and assess environmental performance indicators to ensure that goals are met. Environmental assessments should be integrated into emergency planning processes, following the Environmental Impact Statement model mandated by the National Environmental Protection Act. Environmental Impact Statements should (but currently do not) specifically include disaster-hazard considerations. Rapid environmental assessments should be conducted as part of disaster damage assessment and should be an integral part of response/recovery considerations (Kelly 2001).

Both environmental managers and emergency managers must be cognizant of the importance of environmental justice/equity issues in the context of hazard and vulnerability. Hazards of any type have a disproportionate impact on the poor and disadvantaged. A number of thorny equity issues are coming to a head in the environmental management world, among them: industrial plant and landfill siting; development in industrial or depressed areas; residential settlement on

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reduction measures, including environmental management and sustainable development initiatives."

slopes or in other marginal areas; higher population density; immigrants and language differences; differential access to social services and information sources. Most of these issues have not yet been adequately addressed in emergency management planning or community dialogue.

The United States (and, to a certain extent, other nations) has become sensitized to the possibility that terrorists might attack with Weapons of Mass Destruction (nerve agents, bioweapons, "dirty bombs"). The unpleasant reality is that terrorists don't have to try that hard to create death and destruction. The ubiquitous gasoline tanker would make a handy (and easily procured) bomb; there are over 20,000 chemical plants in the US that contain enough extremely hazardous materials to require reporting under EPCRA. The existence and availability of these and other so-called "weapons of convenience" will require a much closer and more explicit cooperation between environmental professionals and emergency managers to: assess the immediate and long-term threats; to identify both mitigation and response strategies; and to manage long-term recovery and clean-up operations.

Environmental management and the four phases of emergency management

At the most practical and operational levels, environmental professionals can contribute directly to the practice of emergency management throughout all four phases.

<u>Mitigation</u>

- Inventory environmental assets
- Identify environmental projects and environmental enhancement opportunities as part of hazard mitigation planning
- Integrate local land use and growth management ordinances into hazard mitigation planning
- Assist in developing Hazard Mitigation Plans
- Establish and monitor Environmental Performance Indicators for assessing progress & operation of environmental projects conducted as part of mitigation
- Identify and monitor environmental regulatory requirements
- Identify and monitor government funding programs to support environmental mitigation actions

Preparedness

- Identify/assess environmental vulnerabilities and threats (analysis of Environmental Impact Statements)
- Review emergency management policies, plans, and procedures for potential environmental impacts
- Assist in emergency preparedness planning (especially for hazardous materials incidents)
- Assist in the activities of the Local Emergency Planning Committee (under EPCRA)
- Assist in developing response procedures to ensure that environmental factors/hazards are addressed

Response

- Conduct Environmental Impact Assessments
- Identify environmental threats/damage related to disaster effects
- Assist in response to environmental hazards or emergencies (e.g., orphan drums; releases; etc.)

Recovery

- Identify environmental damage
- Identify possible recovery options for environmentally sensitive areas
- Identify enhancements to environmental assets/resource for recovery
- Monitor Environmental Performance Indicators (short & long-term)
- Assist in and monitor debris removal and clean-up (e.g., for hazardous materials/wastes problems)
- Identify and monitor environmental regulatory requirements.
- Identify and monitor government funding programs to support environmental mitigation actions

Conclusion

Considering the extent to which the concepts and practices of environmental management and emergency management overlap and interpenetrate, it is surprising to see the number of

publications that examine how the two fields should (and by implication do not) interact in mutually-supportive ways. The most common connection between the two fields usually occurs in the setting of Local Emergency Planning Committee activities to plan for response to chemical spills and releases. Emergency managers largely ignore the full range of environmental issues. When issues and practices do come into conflict (e.g., thinning the forests; use of dispersants in chemical spills), it is vital that environmental management have a seat at the table. Both disciplines must cooperatively seek solutions that will maximize environmental quality as well as meet the needs of disaster preparedness and recovery.

Researchers and practitioners in other countries – particularly in the European Union and Asia – have paid considerably more attention to the effects of environmental conditions on disaster vulnerability and to the necessity of adding an environmental consciousness to the planning for and implementation of disaster response. We have much to learn from our colleagues overseas regarding the most fruitful cooperation between environmental management and emergency management.

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