OSWER-HED

Health & Environment DIGEST

A publication of the Freshwater Foundation
Featuring information from its Health & Environment Network

Volume 5, No. 11 January/February 1992

A Digest Special Report: Chemical Emergency Planning and the Medical Community

When a bell sounded at 1:05 pm at the Phillips Petroleum Company's Houston Chemical Complex on October 23, 1989, employees knew it wasn't normal. Minutes later, a massive explosion ripped the refinery, killing 23 people and seriously injuring many others.

Dazed and wounded workers fleeing the shattered plant were met by emergency responders. Paramedics set about treating the injured and arranging for their transport to hospitals. First responders radioed helicopters and ambulances for assistance and notified hospitals of incoming patients. They set up a sign-in area for employees leaving the plant to determine how many were safe and how many were still inside. They kept in contact with the hospitals to check on the accident victims and to make sure treatment centers weren't being overwhelmed. By 6:00 pm, the rescue was nearly complete.

What made the response to the Phillips emergency so effective? The plant, police, fire fighters, medical responders, and hospitals were all part of a well-rehearsed plan designed specifically for dealing with local chemical emergencies. The plan, created and coordinated by the Pasadena (Texas) Local Emergency Planning Committee, was the direct result of federal legislation, the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), commonly known as Title III of the Superfund Amendments and Reauthorization Act (SARA).

Planning requirements

Under SARA Title III, each state must establish a chemical emergency planning structure. To aid local planning, industries, laboratories, hospitals, and other facilities are required to identify the extremely hazardous substances (EHSs) (above specified quantities) that they keep on the premises. Title III also requires facilities to supply state and local planners with information about hazardous chemicals in the community. Because citizens should be aware of chemical hazards in their community, Title III provides access to information about these hazards and a process for preparing responses to the potential emergencies they pose.

The State Emergency Response Commission (SERC) established by the governor of each state guides chemical emergency planning. Each SERC comprises a broad spectrum of organizations, including state agencies (environmental, emergency management, health, transportation, etc.), environmental and public interest groups, health professionals, and the media. The SERC, in turn, designates local planning districts and appoints, supervises, and coordinates Local Emergency Planning

Editorial Board

Richard H. Adamson, Ph.D.
National Cancer Institute

Henry A. Anderson, M.D.
Wisconsin Division of Health

Ralph Cook, M.D.
Dow Chemical Company

John Doull, M.D., Ph.D.
University of Kansas Medical Center

Vernon N. Houk, M.D.
Centers for Disease Control

Barbara S. Hulka, M.D., M.P.H.
University of North Carolina

Renate Kimbrough, M.D.
Institute for Evaluating Health Risk

John Last, M.D.
University of Ottawa

Robert W. Leader, D.V.M.
Michigan State University

Jack S. Mandel, Ph.D.
University of Minnesota

Raymond R. Neutra, M.D., Dr. P.H.
California Department of Health Services

Victor W. Sidel, M.D.
Albert Einstein College of Medicine

Arthur C. Upton, M.D.
New York University Medical Center

Barbara Scott Murdock
Editor

By James Makris, Director, Chemical Emergency Preparedness & Prevention Office, US EPA

Committees (LEPCs).

The LEPCs develop and maintain emergency response plans, focusing on facilities that handle EHSs in amounts above specified thresholds. Because a variety of perspectives is essential to effective emergency planning, Title III specifies that LEPC members be drawn from elected state and local officials, police, fire fighters, public health agencies, schools, environmental groups, hospitals, the media, transportation agencies, and others. More information on Title III is available from the EPA's hotline on Title III, (800) 535-0202.

Role of the health community

Health professionals play a central role in dealing with chemical emergencies, both in evaluating chemical risks and in coordinating community medical resources. For this reason, Title III requires that, under some circumstances, industries must provide trade secret information on the properties of hazardous chemicals to health professionals—even when they normally withhold such information from the LEPC. Health professionals then use the information, plus that normally received from industries, to help the LEPC rank chemical risks in the community.

Emergency medical technicians and other first responders, hospitals, and health departments all contribute to emergency planning. First responders, such as emergency medical technicians, can help the LEPC design such crucial steps in initial response to an emergency as how and where to set up triage stations, and how to transport the injured to hospitals.

Hospitals can offer information on treatment capacities and medical resources in the community. The emergency plan must clearly identify treatment centers so responders will know where to send the injured, who should monitor the transfer of victims, and where to learn more about chemical exposure treatment and decontamination. Hospitals can further provide supplementary training to police, fire fighters, and paramedics on such topics as the health risks of chemical exposures and how to decontaminate victims.

Hospitals and medical facilities themselves may use hazardous chemicals. Thus, they too may be required to report their chemical hazards so the LEPC can address them in the community plan. Hospitals should also develop their own emergency response plans so they can coordinate with emergency responders and evacuate patients safely if a chemical incident happens in or near the hospital.

Health departments can point first responders to available resources, such as hotlines and computer databases, that provide information on the hazards and health effects of specific chemicals. They can notify the public of chemical risks by distributing information through schools, physicians' offices, and other networks traditionally used to educate the public about health issues. Other health services, such as the Poison Information Centers (Poison Control Centers), have information on the health effects of chemicals and treatment for chemical exposures and injuries.

Health departments and hospitals can also research the health effects of chemicals and establish treatment protocols to be used in an emergency. To identify and monitor chemical risks further, it's also important to maintain up-to-date information on symptoms and illnesses in the community that may be related to chemical exposures.

Federal & international resources

Chemical emergency planning is most effective where industry, government, the medical community, public-interest groups, and others have established working relationships and coordinate their responsibilities cooperatively. While the primary burden for preventing chemical accidents falls on the facility that uses the chemicals, if an accident occurs, public safety depends on the successful cooperation of groups in the LEPC.

In planning, training, and during an emergency, LEPCs and the SERC can turn to the federal government for technical assis-

References: 1) Environmental Protection Agency (EPA), Sept. 1988. Chemicals in Your Community; 2) Environmental Protection Agency (EPA), February 1991. Successful Practices in Title III Implementation. Office of Solid Waste & Emergency Response; 3) Merriman, M, March 1990. Occupational Health & Safety. "Emergency Medical Response Teams React Swiftly to Phillips Plant Tragedy;" 4) Merriman, M, March 1990. Occupational Health & Safety. "Not a Drill;" 5) National Governors' Association (NGA), 1990. The Role of State Health Agencies in Chemical Emergency Management. Center for Policy Research; 6) NATO/CCMS, March 1990. Pilot Study on Disaster Preparedness Plans Responding to Chemical Accidents; 7) United Nations Environment Programme (UNEP), 1988. APELL: A Process for Responding to Technological Accidents. Industry & Environment Office.

tance, guidance, and information. The National Contingency Plan, adopted in 1968, established a federal response structure. The National Response Team and the Regional Response Teams coordinate federal resources at the national and regional levels. Federal On-Scene Coordinators monitor accidents and manage direct federal actions, and the National Response Center, which can be reached at (800) 424-8802, maintains a national database on chemical releases.

In addition, Congress created the Agency for Toxic Substances and Disease Registry (ATSDR), part of the Public Health Service, to provide training to health professionals and gather information on the diagnosis and treatment of illnesses and injuries caused by exposure to hazardous substances. The Centers for Disease Control (CDC) sponsor programs on environmental emergencies and provide leadership and guidance in responding to public health emergencies as well as in preventing and controlling diseases. Both ATSDR or CDC can be reached 24 hours a day, nationwide, at (404) 639-0615.

Chemical emergency planning has international applications as well. A catastrophic release, like the one in Bhopal, India, that killed thousands, or the warehouse fire that contaminated vast stretches of the Rhine river, ignores political boundaries.

Neighboring countries may coordinate chemical emergency planning. An example? Cameron County, Texas, has collaborated with an LEPC-like organization in nearby Matamoros, Mexico, to prepare response communities on both sides of the border for chemical incidents. The collaboration is part of a Joint Contingency Plan involving emergency planning for 14 pairs of cities along the US-Mexican border. And EPA and the Department of Health and Human Services, including CDC, are involved in a NATO-sponsored pilot study on sharing health and medical information related to emergency planning and review member countries' emergency plans.

The United Nations Environment Programme (UNEP) has developed an international emergency planning initiative similar to Title III. The goal of "Awareness and Preparedness for Emergencies at the Local Level" (APELL) is to assist communities worldwide in developing emergency plans and preparing for chemical incidents. EPA is also working with the World Health Organization (WHO) on chemical safety issues, including organizing a meeting on health and medical aspects of chemical emergency planning. Through such international exchanges, countries can share ideas and work together to improve emergency planning efforts.

Chemical emergency planning is most effective where industry, government, the medical community, public-interest groups, and others establish working relationships and coordinate their responsibilities

Teamwork is key

Preparing for and preventing chemical releases requires the dedicated participation of many groups in a community. Industries can take steps to prevent chemical releases, but should one occur, workers must be prepared through drills and exercises to protect themselves from injury and exposure. People living near such industries need to be aware of the risks and to know proper safety responses if a chemical release should happen.

Minimizing the damage of a chemical incident requires the coordination of groups that include emergency medical technicians, police, fire fighters, hospitals, medical professionals, and public health professionals. But the plan can only be effective when all are aware of their roles and are prepared to act as a team. As experience has shown, only an informed and organized community can keep a chemical accident from becoming a disaster.

Commentary

Getting Fingerprints On The Knife

By Albert J. "Bud" Fekete, Technological Hazards Coordinator, Louisville & Jefferson County, Kentucky, Disaster & Emergency Services

In 1985, a hexane leak in Louisville, Kentucky, caused an explosion that ripped streets and destroyed houses and buildings above two and a half miles of sewer lines. The incident prompted the City of Louisville and surrounding Jefferson County to adopt an ordinance that required industries and facilities to report their hazardous materials and develop plans to deal with emergencies. The requirement not only gave Jefferson County an early start in emergency planning, but enabled it to become a model for integrated emergency management. Jefferson County's health department has developed haz-mat training for the federal Agency for Toxic Substances and Disease Registry. Its Local Emergency Planning Committee (LEPC) includes members from all 210 reporting facilities, which means that industry is widely involved in local emergency planning. Because of its effective integrated planning, Louisville/Jefferson County was chosen as a test site for the Computer Aided Management of Emergency Operations (CAMEO II) software program. And today, the county's planning goes beyond SARA Title III by requiring all facilities with hazardous materials to develop on-site and off-site plans. In the following article, Bud Fekete discusses the strengths of the integrated approach to emergency management—BSM.

Emergency management typically consists of four phases—the Emergency Response Cycle—carried out by the agencies responsible for one or more of the phases—the emergency-response community.

Mitigation includes any activity that prevents or reduces the chances for a disaster, or reduces the damaging effects of an unavoidable disaster. We can't stop a tornado or prevent all hazardous material incidents, but we can reduce their damaging effects.

Preparedness includes plans or preparations made to save lives and property in a disaster. All agencies involved in the Emergency Response Cycle must take part in planning their role. Once plans are in place, a community is ready for the *Response* phase of the cycle, when plans are put in action and tested.

In the *Recovery* phase, activities return the situation to normal. In this phase, the incident command may shift from the action agencies—police, fire, or emergency medical services—to the health department or the emergency management agency.

Each agency has its expertise

Why adopt an integrated response? Because no single agency has the expertise to handle all phases of response effectively. The fire department may be the most qualified to handle patching, plugging, and diking, but isn't expert in monitoring test wells or supervising the removal of contaminated soil. The police—not the fire department—know best how to handle traffic control. The health department, not the fire or police chief, has trained professionals with a statuary requirement to protect public health. Each agency should be part of a unified command structure that makes decisions based on the best information available from all players.

If only one agency carries the whole haz-mat response load, weaknesses in that agency can hinder the entire delivery system. But if we take advantage of each agency's expertise, we get the best there is in the community, instead of pinning success on one superagency.

In an era of shrinking budgets, integrated planning avoids unnecessary duplication. Every agency doesn't need a fully equipped hot-zone entry team. Instead, planners can look at each agency's mission and identify the resources they need versus the ones they control. They can set up mutual-aid agreements with the private sector as well as with other emergency-response agencies. SARA Title III has caused communities to identify their resources for haz-mat response. Because a great deal of specialized equipment is available in the private sector, industry must be part of an integrated response—not just for equipment, but for expertise in handling emergencies in their facilities and products.

In an integrated approach, the Incident Commander (IC) can use each agency's strengths and offset its weaknesses with strengths from other agencies. A Unified Command Structure allows the IC to make intelligent decisions after receiving advice from all key agencies. Another advantage—in an era of increased liability, it's important for many agencies and experts to share responsibility in planning for and handling chemical emergencies. It means that if the IC has to appear in court, he will have many people's fingerprints on the knife.

A few disadvantages

Like everything else, an integrated system has some disadvantages. Because the system is only as strong as its weakest agency, planners must identify an agency's weaknesses early and take steps to train its staff or shift part of its responsibility to a stronger agency.

Integrated planning also takes longer, since all agencies in the four phases of the Emergency Response Cycle must participate. But if they help create it, they will support it. A few people can't simply develop the plan in some Ivory Tower: the plan must be a child of

The *Health & Environment Digest*® (ISSN 0893-6242) is published at Freshwater Foundation at Spring Hill Center, 725 County Rd 6, Wayzata, MN 55391. The *Digest* is a monthly publication of the Freshwater Foundation, a public nonprofit foundation whose mission is to help keep water usable for human consumption, industry, and recreation. The Foundation supports a variety of research and educational programs dealing with freshwater resources. The Freshwater Foundation's address is: Spring Hill Center, 725 County Rd 6, Wayzata, MN 55391; (612) 449-0092.

The *Digest* draws on the expertise of a network of representatives in 22 schools of public health, 50 state health departments, and over 75 research institutions, government agencies, state public health associations, and medical societies. Start-up funds were provided by a grant from the Bush Foundation.

Subscriptions to the *Digest*: government/public sector, $90; private sector, $115; international, $130 (outside the U.S., Canada, and Mexico). Special rates are available for orders of two or more. Second class postage paid at Wayzata, MN and additional entry. POSTMASTER: Send address changes to: The Health & Environment Digest, Spring Hill Center, 725 County Rd 6, Wayzata, MN 55391; (612) 449-0092.

Copyright © 1992, Freshwater Foundation.

the street—because that's where it has to work, in the street at three o'clock in the morning.

Finally, an integrated system requires the coordination of a large number of agencies, people, and personalities. Planners must be able to blend all the players and may have to do some "engineering" to get people to work together. Because there is no room for freelancing during a haz-mat, each agency must understand its role. Everyone must support the IC.

What are the rewards?

In Louisville and Jefferson County, Kentucky, we wanted a plan that would bring all parts of the emergency-response community together. We've found that this integrated approach works well, and provides the community with the best combination of personnel and equipment during haz-mat incidents. When each agency can focus on what it does best, the IC can draw on the best the community has to offer.

Natural Disasters

Natural Disasters and Emergency Planning

by Eric K. Noji, MD, MPH, Center for Environmental Health & Injury Control, CDC

Earthquakes, hurricanes, floods, tsunamis, fire, tornadoes, and extreme temperatures have claimed some 3 million lives worldwide in the past 20 years, affected the lives of at least 800 million more, and caused property damages exceeding $23 billion. And, as more and more people settle on flood plains and in seismic- and hurricane-prone areas, catastrophic disasters with millions of casualties become more likely.

To respond effectively to such emergencies, we need to know what relief supplies, equipment, and personnel are appropriate to specific natural disasters. Past emergency health decisions have often been based on insufficient, even false information. The result was inappropriate aid, wasted resources, and countereffective health measures. Examples? After the 1976 Guatemalan earthquake, foreign donors sent 100 tons of unsorted medicines to the country. Ninety percent were expired, already opened, or labeled in foreign languages. Other times, relief efforts have sent mobile hospitals and teams of specialized surgeons, when sanitary engineers might have been more appropriate.

To determine what relief is needed, it's essential to have better epidemiologic knowledge of the causes of death, injuries, and illnesses caused by specific natural disasters.

Floods

Floods account for roughly half of all natural disasters and a similar proportion of deaths. Fast-flowing water carrying debris, boulders, and fallen trees is the primary cause of injury and death. In the US, many who have died in flash floods were in automobiles. The primary cause of death is drowning, followed by trauma and hypothermia.

Among survivors, most injuries are minor, such as lacerations, skin rashes, and ulcers. Cuts are often contaminated, and primary wound closure should be done with caution. Snakebites may result as rising waters drive snakes to higher ground. If flood waters break oil or gasoline storage tanks and the oil film ignites, fires may cause many casualties.

From a public health perspective, floods may disrupt water purification and sewage disposal, cause toxic waste sites to overflow, and dislodge chemicals stored above ground, thus exposing people to toxic biological and chemical agents. Flood victims may be vulnerable to waterborne diseases, at risk of vector-borne disease from enhanced vector-breeding conditions, and exposed to respiratory infection in crowded temporary shelters.

Nevertheless, mass vaccination programs usually serve only to divert resources from other more important tasks. The most effective approach is epidemiologic surveillance to quickly identify and address increased communicable disease risk in flood-stricken areas.

Cyclones & Tornados

Cyclones, hurricanes, and typhoons are usually accompanied by heavy rains and flooding. Nine out of 10 hurricane fatalities are caused by drownings associated with coastal storm surges. Causes of death and injury include drowning, collapse of houses from wind and water, penetrating wounds from broken glass or wood, blunt trauma from floating debris or from entrapment in mud slides that may accompany floods, and electrocution during post-disaster cleanup. In the 1970 Bangladesh cyclone, many survivors suffered from "cyclone syndrome," severely abraded chest, arms, and thighs, incurred by holding to trees as they were buffeted by fast-moving water. Those too young, too old, and too weak to hold onto trees were lost in the storm.

In the past 50 years, tornadoes have led to more than 9000 deaths. The leading causes of death are craniocerebral trauma and crushing wounds of the chest and trunk. But, in both tornadoes and cyclones, fractures, lacerations, and other soft-tissue injuries are common. Because the wounds may contain highly contaminated material such as soil, they should be flushed with saline and primary closure avoided.

Volcanoes

In the past 400 years, volcanic eruptions have claimed more than 266,000 lives, with fatalities in about 5 percent of

all eruptions.

Life-threatening health effects include: suffocation from inhalation of airborne ash, scalding by superheated steam, and surges of lethal gas. Pyroclastic flows—currents of hot gases and particles that flow down the slopes of a volcano—are particularly lethal. Mudflows or *lahars*—flowing masses of volcanic debris mixed with water—account for at least 10 percent of all volcano-related deaths. The sudden release of toxic volcanic gases from deep crater lakes can cause effects that range from death to pulmonary edema, irritant conjunctivitis, joint pain, muscle weakness, and blistered skin

A volcanic eruption like the recent Mt. Pinatubo eruption in the Philippines can also generate tremendous quantities of ash, collapsing buildings and causing severe trauma to the occupants. Ash can irritate the eyes, mucous membranes, and respiratory system. Upper airway irritation, cough, and bronchospasm are common, as well as exacerbated chronic lung diseases. Heavy ashfall may cause severe tracheal injury, pulmonary edema, and bronchial obstruction, leading to death from acute pulmonary injury or suffocation. Primary closure of wounds contaminated by mud and volcanic material can result in gangrene, osteomyelitis, compartment syndrome*, and sepsis.

Most deaths stem from immediate suffocation and, to a lesser extent, burns or blunt trauma. Advanced cardiac and trauma life-support would probably be too late to save asphyxiated victims. Because patients with respiratory symptoms may well develop acute respiratory distress syndrome, it's advisable to admit them to intensive care.

Earthquakes

In the past 20 years, earthquakes have caused more than a million deaths and injuries worldwide. Death and injury result primarily from the collapse of buildings that were inadequately designed for earthquake resistance. In major earthquakes, death can be instantaneous, as from severe crushing injuries of the head or chest, hemorrhage, or drowning from earthquake-induced tidal waves (tsunamis); rapid (within minutes or hours), as from asphyxia, hypovolemic shock, or exposure (hypothermia); or delayed for days, as from dehydration, hypothermia, hyperthermia, crush syndrome, and postoperative sepsis.

Most people requiring medical assistance will have minor cuts, bruises, and simple fractures. Infected wounds and gangrene were major problems after the 1988 Armenian earthquake. Patients trapped by rubble for hours or days may also develop compartment syndrome, requiring fasciotomy or amputation. Such patients may also have significant rhabdomyolysis** and should be watched closely for symptoms of crush syndrome, such as hypovolemic shock, hyperkalemia, renal failure, and fatal cardiac arrhythmias.

Rapid response in searching collapsed buildings to rescue trapped victims is critical. A survey of 3619 survivors of the 1980 Italian earthquake shows that 93 percent of those who were trapped and survived were extricated in the first 24 hours. The study concluded that 25 to 50 percent of the victims who died slowly could have been saved if they'd had immediate lifesaving first aid. Thus, to reduce earthquake mortality significantly, rescuers should focus on appropriate search and rescue within the first two days.

Finally, an earthquake may damage nuclear power stations, hospitals with dangerous biological products, hydrocarbon storage areas, and hazardous chemical plants.

Epidemics

While natural disasters rarely result in outbreaks of infectious diseases, they may increase the potential for disease transmission. The most frequent increases in communicable disease are caused by fecal contamination of water and by respiratory spread (e.g., measles). Unburied bodies, particularly if death resulted from trauma, are unlikely to cause outbreaks of diseases such as typhoid, cholera, or plague, though they may transmit gastroenteritis or food poisoning if they contaminate water. Demands for mass burial or cremation aren't justified on public health grounds.

For more, see: Noji, 1991. *Critical Care Clinics* 7(2): 271-91.

*compartment syndrome: Constriction of a nerve or tendon.
**rhabdomyolysis: Acute, sometimes fatal disease characterized by destruction of skeletal muscle.

Chemical Emergencies

CASE HISTORY

Chemical Spill—USSR!

By Harry L. Allen, PhD, & Harry R. Compton, Environmental Response Team, Office of Solid Waste and Emergency Response, US EPA

In November 1990, a tank-filling accident at a plastics plant in Novopolotsk, Byelorussia, USSR, spilled several thousand gallons—an estimated 30 tons of acetocyanohydrin (ACNH)—on the ground. Misinformation and mishandling of this seemingly minor incident led to the discharge of toxic quantities of acetone and cyanide into tributaries to Latvia's chief inland waterway, the Daugava River. The Daugava supplies drinking water to the cities of Daugavpils (126,700 people) and Riga (915,000 people), supports about 30 percent of Latvia's fishing industry, and is a significant tributary to the Baltic Sea.

Plant officials in Novopolotsk appear to have been told that the spill could be treated with lime and flushed away with water. The hydrolyzed ACNH would then disappear rapidly, posing no risk to human health or the environment.

Unfortunately, while ACNH does hydrolyze rapidly in the presence of alkali, the products of the reaction, acetone and cyanide, may persist for days under alkaline conditions. What's more, travel time down the river from the spill is only about 2.8 days to Daugavpils and nine days to Riga. Under these conditions, it's ill-advised to treat such a spill with lime unless it's also possible to contain it on-site until the cyanide dissipates. Furthermore, whether because of the technical misinformation or for some other reason, Latvian authorities and other downstream users of the river were

not notified.

The result was that an imminent public health threat existed for approximately two days before anyone came to grips with or even realized the problem. A massive fish kill sighted near the Latvian border was the first clue that something was amiss. Large fish died outright, while smaller fish first leapt wildly from the water, became anesthetized, and then died or slowly recovered from stupor as the slug of cyanide- and acetone-contaminated water passed through. These classic symptoms of anoxia in fish reflect cyanide's mechanism, which is to inhibit the cellular transport of oxygen.

The fish kill eventually reached an estimated 300 tons. At this point, Latvian authorities made urgent inquiries to Byelorussian and Soviet authorities about the threat to water supply systems and declared a public health emergency.

Although there are significant municipal and industrial waste problems in the Baltic Republics, there seems to be little training in handling chemical emergencies. In other countries' experiences, a centralized governmental structure makes it difficult to deal with emergencies effectively and quickly. The National Contingency Plan (NCP) of the US, for example, establishes an experienced federal On-Scene Coordinator as the delegated incident manager. This person is supported by a Regional Response Team of representatives of affected state and federal agencies. Interestingly, the Latvians, because of the difficulty of communicating through a central authority, developed an *ad-hoc* structure similar to the US model.

Under the direction of the Ministry of Health, the response management committee dealt with the emergency as though it were a major crisis. Latvian scientists and managers stayed on top of the developing scenario, tracking spill movements and managing spill information as well as they could with the tools at hand. They monitored the Daugava River and water supplies hourly, with a laboratory system coordinated among different state and educational agencies with laboratory capability.

But there were problems: a lack of information, a lack of clear lines of communication, and steady attrition of response personnel from fatigue. The public was calm, but the situation was deteriorating. The Latvians knew they needed help.

In the US, a special provision of the NCP offers on-scene technical assistance at environmental emergencies through the Environmental Response Team (ERT). Realizing their need for special assistance in analysis and field monitoring, environmental criteria development and validation, information on the fate and effects of the toxic substances, and spill response management, the Latvians sought aid from the US EPA. Under the provisions of a bilateral agreement with the USSR, the EPA sent a special team, including two members of the ERT, to Riga.

The EPA team arrived two weeks after the spill to find near-panic concern about public health and fish toxicity. Information had filtered out from various sources that ACNH was much more toxic than officials admitted, and cyanide levels near Riga were rising. Riga had been on emergency water rationing for over a week, and water pressure was dangerously low. The lack of water curtailed day-to-day activities, with an economic impact estimated at 25 million rubles per day.

The effect of the arrival of the US team was electric. It created a nucleus around which diverse groups involved in the spill coalesced. Team members worked directly with spill managers and scientists for about a week, reviewing information and sharing expertise on all aspects of spill response, from sampling and analysis, data presentation, and water treatment to general spill management and legislation. Finally, the team provided what the Latvians needed most—assurance that they were handling the situation correctly.

As one US official wrote later, "A US Team...played a key role in assessing the problem and in calming the public. One result is that the Latvians—and perhaps others in this country—have an enhanced understanding of the need to establish systems to work in crisis situations. Another is that, for a small expenditure, the US was able to make a highly positive impression on both the people of Latvia and much of the Soviet leadership..."

Team leaders included Jim Makris, Director, EPA, Office of Chemical Emergency Preparedness and Prevention; Doug Kuehl, Chemist, Environmental Research Lab, Duluth, MN; Harry L. Allen, PhD, and Harry R. Compton, Environmental Response Team, Office of Solid Waste and Emergency Response, US EPA. For more detail, contact: Harry Allen, PhD, (908) 321-6740.

RISK ASSESSMENT

Transport Spills May Be Less Frequent Than Thought

By Joseph M. Posid & Wendy E. Kaye, PhD, Division of Health Studies, ATSDR

While many national data bases are designed to obtain information on hazardous substance emergencies, they often have data on only a small proportion of the emergencies that occur each year.[1] What's more, they offer very little information about the public health consequences of such events.

To get a better understanding of the morbidity and mortality associated with hazardous substance emergencies, the Agency for Toxic Substances and Disease Registry (ATSDR) is collaborating with a number of state health departments to develop, implement, and evaluate a state-based Hazardous Substance Emergency Event Surveillance (HSEES) system. Because such emergencies are unlikely to be random, ATSDR officials believe it should be possible to identify the risk factors associated with deaths and injuries from these emergencies. This, in turn, should make it possible to reduce, alter, or eliminate the risk factors and the resulting morbidity.

So far, preliminary HSEES data suggest that hazardous substance emergencies happen far more frequently at fixed facilities, such as factories, than during the transport of chemicals from one place to another.

Five states—Colorado, Iowa, Michigan, New Hampshire, and Wisconsin—have taken part in HSEES since it began in January 1990. In January 1992, five more states—Oregon, New York, North Carolina, Rhode Island, and Washington—will begin to collect data.

ATSDR officials hope that HSEES will both answer some general questions about the public health effects of hazardous substance emergencies and give state health departments a better understanding of the effect of these emergencies on citizens' health. They further

hope that states can use HSEES results to identify what chemicals are being released within their borders, when and where the events are most likely to occur, who is being injured, and why injuries occur. The knowledge should help state agencies, including health departments, prevent injuries and deaths related to hazardous substance emergencies.

In the HSEES project, state health departments determine which state agencies will be notified of hazardous substance events meeting the protocol's case definition. These agencies may include departments of natural resources or environment, public safety, or emergency management agencies. Once notified, the state health departments begin an investigation using a data collection form developed at ATSDR. The form contains more than 80 variables describing hazardous substance events and their morbidity and mortality. The investigation focuses on: the temporal and spatial description of the event, the chemicals involved, and the morbidity and mortality that resulted. The resulting data are transferred to ATSDR every three months for analysis.

Information collected on where and when the event occurred includes whether the event took place during transport of a chemical or at a fixed facility, such as a manufacturing plant, and whether the event occurred inside or outside of a building. It covers the weather, the time of day, and the day of the week that the event occurred. It includes data related to possible exposure, such as how close the emergency was to residential areas; what the primary use of the nearby land was—whether industrial, commercial, agricultural, or residential; how many people live within one-quarter, one-half, and one mile of the event; and how many were actually home when it took place.

Table 1

Distribution of injured people within population group, by type of event, January 1, 1990-June 30, 1991 (N=766)

Population Group	*Fixed Facility*		*Transportation*		*Total*	
	#	%	#	%	#	%
Employees	357	94.9	19	5.1	376	49.1
Responders	129	79.6	33	20.4	162	21.1
General Public	222	97.4	6	2.6	228	29.8
TOTAL	708	92.4	58	7.6	766	100.0

An emergency is included in HSEES if the chemicals released are among the 200 substances identified by ATSDR to be the most hazardous substances found at Superfund sites, as published in the Federal Register,[2] or if they include chlorine, sodium hydroxide, or hydrochloric, nitric, phosphoric, hydrofluoric, acrylic acid, or any insecticide or herbicide. Information is collected on the name and quantity of each chemical released, on the type of release (spill, vapor, fire, explosion), and on whether environmental sampling was conducted.

Information collected on morbidity and mortality falls into two categories: The first describes deaths and injuries that result from the event, including who was injured (employee, responder, or member of the general public), the number and severity of injuries, and how far the injured people were from the event at the time of injury. The second describes the steps taken to prevent deaths and injuries, such as the type of personal protective equipment that the casualty used, or the use of decontamination, evacuation, and in-place sheltering.

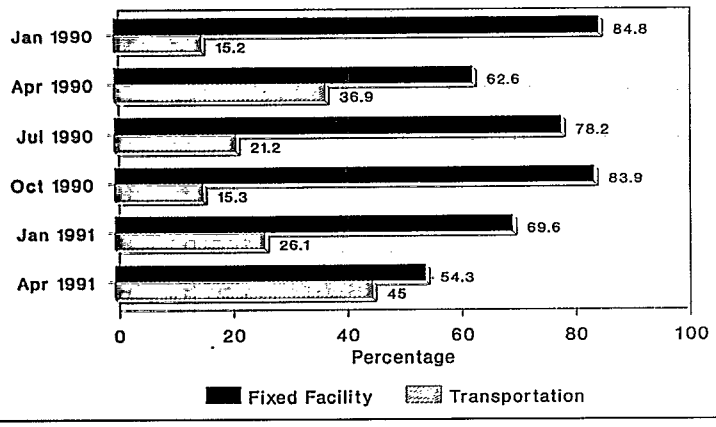
By the end of June 1991, 933 events meeting the case definition had been entered into the HSEES system. Preliminary findings suggest that more than 70 percent of the events meeting the case definition occurred in fixed facilities, such as factories, warehouses, or storage depots (Figure 1). Further, more than 90 percent of all injuries sustained by employees, first responders, and the general public resulted from fixed facility events (Table 1). The number and types of events seem to vary according to the time of year. During April, May, and June, for example, there are more events involving insecticides, herbicides, and ammonia. Additional analyses indicate that incidents involving some chemicals, such as herbicides or PCBs, are less likely to cause injuries than events involving such chemicals as insecticides or acids.

These preliminary results must be tempered by the fact that the states participating in the HSEES system aren't representative of any region or industry, or of the US as a whole. Thus, the preliminary results may not apply to other areas of the country. To learn whether the pattern will hold in the rest of the nation, ATSDR intends to expand HSEES to more states over the next few years.

References: 1) Binder, S, 1989. Am J Pub Hlth 89:1042-4; 2) Hazardous Substances Priority List, Toxicological Profiles; Second List. October 20, 1988. 53FR41280.

Figure 1. Proportion of Events

Fixed Facility and Transportation by Quarter (Jan. 1, 1990-June 30, 1991)



Assessing The Kuwaiti Oil Fires

During the 1991 Persian Gulf war, Iraqi forces poured oil into Gulf waters and systematically ignited hundreds of oil wells in Kuwait. The magnitude of the environmental crisis brought an immediate international response. US and United Nations technical organizations developed plans for atmospheric monitoring and modelling, environmental remediation and restoration, oil discharge response, monitoring health effects, and offering guidance and training.

When Kuwait was liberated on February 28, the plans went into action. The US Interagency Air Assessment Team travelled to Kuwait and Saudi Arabia to help government authorities in those countries. The National Oceanic and Atmospheric Administration (NOAA), the Departments of Defense and Energy, the National Science Foundation (NSF), and the Environmental Protection Agency (EPA) analyzed the smoke plumes and are following their environmental effects. The US Department of Health and Human Services worked with the Kuwaiti Ministry of Public Health to assess the health effects from exposure to air pollution from the fires. And the National Response Team, which represents over 15 government agencies and departments, provided technical assistance for addressing the oil spills.

The Kuwaiti Ministry of Health, in collaboration with CDC, developed a notification system to alert Kuwaiti residents to air pollution levels that could threaten health; developed education programs for physicians to help them explain the effects of oil smoke exposure to their patients; developed programs to help the public learn how to avoid excessive exposure to air pollution and to understand its potential health hazards; instituted a surveillance program in hospital emergency rooms to track respiratory illness that might be related to the fires; set up a study of asthmatic patients at the Kuwait Center for Allergic Diseases to learn whether the oil smoke affected their condition; and designed a longitudinal study of people who were highly exposed and not exposed to smoke from the oil fires. The study may enable investigators to determine long-term effects from exposure to the fires.

To date, given the magnitude of the environmental problem, findings are surprisingly encouraging. The last oil fires were extinguished in November 1991, sooner than predicted. While they burned, prevailing winds blew most of the smoke south over the sparsely inhabited desert between Kuwait and Saudi Arabia, or east over the Gulf. When smoke drifted over Kuwait City, Kuwaiti living patterns helped protect the public: Because of heat and dust, Kuwaitis tend to stay indoors and to use air conditioning, thus buffering themselves against polluted outside air. And the extra care given the patients with asthma may have had a beneficial effect.

While the data are still being analyzed, it looks as though the fires are unlikely to cause a "nuclear winter;" their environmental damage seems to be confined to the Gulf region. The CO_2 emissions are unlikely to have an important effect on global climate. And, while it will take some years to learn the medium and long-range effects of the fires and oil discharges on human health, the data to date do not indicate an epidemic of respiratory disease.

For more information on health surveillance, contact: Ruth Etzel, MD, PhD, at CDC, (404) 488-4227, or Paul Seligman, MD, NIOSH, (513) 841-4353. For a copy of the executive summary, "Report to Congress: US Gulf Environmental Technical Assistance," contact: Timothy Titus, EPA, (202) 260-0154.

MEDICAL PLANNING

SARA and Hospital Planning

By Linda Young Landesman, MSW, DrPH, Albert Einstein College of Medicine

How effective has SARA Title III been in making hospital and health professionals aware of emergency preparedness? Have hospitals changed any of their procedures for responding to chemical accidents since SARA Title III passed?

To assess the situation in New York State, I undertook a study in fall 1989 in cooperation with the New York chapter of the American College of Emergency Physicians, and mailed a survey about chemical accidents to emergency department directors of acute-care hospitals across the state. The survey, which drew a response from 174 hospitals (a 73 percent response rate), was the first to assess whether SARA Title III or any environmental legislation has had any effect on the allocation of health resources and staffing in response to environmental emergencies.

The research, which built on a 1986 survey by the Office of the New York Attorney General, looked at changes in the number of hospitals that had developed disaster plans for responding to chemical accidents; and measured variation in their preparation for chemical emergencies. More important, the investigation helped define characteristics of the hospitals, the professionals, and the implementation of the legislation in the better-prepared hospitals.

The study protocol defined two components that contribute to a hospital's ability to respond to chemical accidents. The first is the organizational preparation made by the hospital (staff training, emergency response plan, etc.). The second involves modifications or designations made within the facility (designated decontamination room, proper equipment, ability to test blood, etc.).

Interestingly, SARA had different effects on each component. Involvement in an LEPC was a good predictor that the organizational elements were in place, that, for example, the emergency department had developed a response plan or undertaken staff training to address a chemical emergency, but did not predict whether the facility itself had been modified to handle the emergency. Results also indicated that if emergency department directors were aware of and involved in implementing SARA, both the organization and the facility were more likely to be prepared. While involvement in an LEPC alone was related to organizational preparedness, awareness of and participation in the implementation of SARA within the hospital made it even more likely that the hospital was prepared.

In 1989, significantly more of the responding hospitals—56 percent—had disaster plans for response to chemical accidents than in 1986, when only 26 percent had such plans. The study further grouped hospitals according to the number of accidents that had occurred between 1983 and 1989 in the counties where they were located. The number of hospitals that had plans for response to a chemical accident had increased 30 percent, both in the group with few accidents (less than 80) and the group with many (81-221).

But having a special disaster plan did not necessarily mean that the hospitals were better prepared. On a 13-item scale measuring the hospital's organizational preparedness, the 1989 study found a significant, but less dramatic improvement over 1986. Despite this change, the hospitals in the state still rank in the bottom third of this scale in 1989. Thus, while the state's emergency

departments are better prepared than they were before SARA Title III, their preparation is far from ideal.

Several characteristics were related to the organization's overall preparedness. First, Emergency Department directors were asked to rank the responsibilities, such as staffing, quality assurance, or issuing reimbursement for care, that they faced in providing care in their department every day. The better-prepared hospitals were those in which the Emergency Department director gave a higher overall ranking to this group of activities. In addition, the more recently the hospital had treated patients exposed to toxins and the better the staff knew what procedures the hospital should follow in a chemical accident, the more likely the hospital was to be organized to deal with a chemical emergency.

But responses on three items in the questionnaire indicated whether a hospital was less prepared for a chemical emergency. If the director believed that only some centers should treat patients exposed to chemicals, that preparation was more of an administrative task than a medical one, and that being prepared only meant more paperwork, then the hospital was less prepared.

Characteristics of the professionals who answered the questionnaire also predicted how well the hospital was prepared. Here, the longer someone had been director, and whether he or she had attended continuing education programs about hazardous materials were significant predictors of good preparation. One might surmise that long-term directors had been able to establish a routine that allowed them time to plan for chemical emergencies, an area that otherwise would not command high priority.

One finding was alarming. The study divided the hospitals into three groups: those that had plans in 1986, those that had developed plans by 1989, and those that had no plans. A comparison of the number of accidents that had occurred in the locations for each group showed that, in 1989, those hospitals with no plans for chemical emergency response were also located in the counties with the highest number of accidents.

The directors answered eight questions about their professional role in preparing for chemical emergencies. The group indicated that it was the role of the director to: be involved in local planning (and not send a designee); participate in developing the community plan; know whom to contact in event of a chemical accident; conduct disaster drills to prepare for chemical accidents; maintain a file of Material Safety Data Sheets. The group, on the average, disagreed that they should get involved only if there were an accident.

Because this study found a direct relationship between physicians' participation in continuing education about hazardous materials and improved hospital preparation, physician training in this area should be expanded. Further, there is evidence that when health professionals take part in community planning for environmental emergencies, their associated hospitals are better prepared. For this reason, we should encourage increased involvement of health professionals in such planning.

Preparing A Hospital Emergency Room

By Anne Le Sher, MD, and Jay Feldstein, DO, FACEP, Medical Center of Delaware, Dept. of Emergency Medicine

Each day, tons of hazardous materials are transported on roads and railroads. While spills are few compared to spills from fixed facilities, the shipments still offer a major source of potential hazardous materials incidents, even in communities with no chemical industry.

Because of this, every hospital emergency department must be prepared to treat contaminated patients. While few can build a decontamination unit, still, with careful preparation and minimum capital outlay, most departments can treat these patients and protect themselves and the community. Here are some guidelines:

The first step for any emergency department director is to become aware of the resources already in the community. By being an active member of the LEPC and Emergency Medical Services (EMS) systems, you can learn which groups are already trained in decontamination and what equipment is available. Contact your local industries to learn about their on-site EMS and fire departments and establish a relationship with community EMS and Fire Departments.

The next step is to learn everything possible about the emergency department: How does the ventilation system work? Where is every outside door and hose connection? What kind of wastewater disposal system is there?

Work with the hospital's maintenance, engineering, and fire and safety departments. Walk out potential routes for contaminated patients to become aware of areas and equipment that can be exposed to contamination. Obtain blueprints of the facility and study them carefully.

Explore educational resources and have someone in the department attend a training course. There are texts available, most dealing with pre-hospital care. Prepare a list of useful "hot-line" numbers, such as CHEMTREC. If you have the resources, obtain computer-based software systems that review identification, decontamination, and treatment after hazardous material exposure.

Your plans will need to address two categories of patients: the walking wounded and the severely traumatized. For either, the best management is to decontaminate the patient as much as possible on-site. This contains the agent, and dramatically reduces the number of people who could be exposed.

The walking wounded are patients exposed to a hazardous material but who exhibit only mild symptoms and haven't suffered trauma. Preliminary decontamination of these patients can take place outside the emergency department, using a garden hose, shower nozzle, plastic kiddie wading pool, and screens. In severe weather, you can decontaminate the patient in a garage or other protected area.

These patients can remove their own clothing, shower, wash their hair, and under their nails. At the hospital, washing should be prolonged and repeated three times. We can't emphasize enough how important it is to use quantities of water and have the patients shower for at least half an hour.

Patients can then dress in hospital issue and be processed in the usual way. Their clothing—including shoes—should be placed in plastic bags, sealed, and placed in another plastic bag that is sealed and labeled with name, date, contaminating agent, and site. If the agent is unknown, indicate this. One difficulty is

that wastewater can't simply be washed into the sewer system, but must be contained for proper disposal. The hospital's Public Safety department should deal with the wastewater and contaminated clothing.

Much more complex is the care and decontamination of a seriously affected and or traumatized victim. It's critical to have the patient's clothing cut away and left at the site of exposure. In most cases, this simple procedure can eliminate 70-80 percent of secondary contamination.

In planning for treatment of severely contaminated victims, it's important to consider how patients will arrive in the department, what path they will travel to the treatment area, and which room they'll be treated in. Ideally, they should be transferred to a clean stretcher outside, brought through a separate entrance, and taken directly to the treatment room. Their path will need to be covered with wide heavy-gauge plastic taped to the floor.

The treatment room will be one in which the ventilation system can be isolated. Simply shutting down the ventilation will increase the risk to people caring for the victim. The room must have doors that can be shut, and empty or closed storage units. The walls and floor must be covered with precut plastic sheeting. All supplies in the room should be disposable. Equipment used with these patients must be decontaminated and may be out of service for days.

Supplies to be stockpiled in the decontamination room include: plastic sheeting and duct tape to secure it, a garden hose, shower nozzles, blankets, green soap and dish detergent, disposable nail files, and preferably, a decontamination stretcher that allows you to wash the patient's skin and hair and control the wastewater. If you use a standard stretcher, you'll need some way, such as floor drains or containment dikes, to control the wastewater.

You will also need personal protective equipment (PPE) for your staff. Because the teratologic effects of many of these compounds are not known, pregnant staff members should not participate. Have staff put on scrub suits, remove jewelry and leather objects, and wear some protective garment over the scrubs, such as a Tyvek or Saranex coverall or at least an OR gown with waterproof sleeves and front. Disposable plastic aprons add more protection. Shoes should be covered with high-top surgical shoe covers and taped to the pant legs. Staff should wear two pairs of milled surgical gloves and change them immediately if they develop holes. Hair must be covered with a coverall hood or some other water-resistant head cover. The eyes should be protected with glasses with side shields or goggles.

Using respirators requires education, frequent testing, and practice. They must be fitted to the individual and, unless they are SCBA type, may only provide a false sense of security. If the contaminant is in a powder or dust, a canister filter respirator may offer reasonable protection, but the type of canister must be specific for the agent.

You are now ready for drills. First do a walk through, then add PPE. Finally, contaminate a victim with fluorescent but invisible powder and run a dress rehearsal, complete with bath and shampoo. A Wood's light will reveal areas that were missed and secondary contamination. Integrate this haz-mat plan with your institution's Disaster Plan and in the next drill, include one or two victims who require decontamination.

In the four years we've been at the Medical Center of Delaware, we have treated victims from at least ten haz-mat incidents. The worst involved some 20 victims. It's something you have to be ready for.

RISK MANAGEMENT

The Whys of Drills & Simulations

In 1987, the Emergency Services for Sioux City and Woodbury County, Iowa, ran a full-scale simulation of an air crash. Some 30 agencies took part, using full equipment to control simulated flames, treating participants who had simulated injuries, hauling victims to hospital emergency rooms.

Two years later—on the same spot—a DC 10 crashed, killing 112 people and injuring 184 others. News of the accident galvanized the community. Emergency responders sped to the scene, this time to put out real fires and treat real patients. Physicians rounded up their staffs, closed their offices, and headed to the hospitals. Over 40 nearby communities sent emergency equipment. More than 400 citizens gave blood, while others phoned in offers of food, blankets, and housing for the survivors and their kin.

The response illustrated several key components of successful emergency management: first, the need for a well-rehearsed disaster plan that forges people and agencies from all over the community into a team; second, the critical role that simulations can play in emergency planning; third, the importance of a sense of community in facing down a disaster.

Sioux City began developing its emergency management skills nearly 40 years ago. The area has three waterways with a history of flooding, a major interstate that carries 6 million vehicles per year, and lies within 100 miles of a Strategic Air Command (SAC) base. It's a major railroad route, a crossroads for underground pipelines, and has a full-service airport. It's hilly—a problem in severe winter storms, and subject to tornadoes and blizzards.

The population is scattered: Woodbury County has 98,000 people; 85,000 live in Sioux City. The public safety system is small: the Sioux City fire department has seven stations and 112 firemen; one 24-hour-a-day ambulance service has two units; a third works from 8 to 5. The police force has 110 officers; only six or seven are on the streets at any one time. The rescue squad has two people: one paid, one volunteer. And the sheriff's department patrols an 877-square-mile territory. To cover the need, all small communities have volunteer fire and ambulance service.

Because the community has limited resources to respond to catastrophes, community leaders decided to focus on planning. The plan involves heads of all city and county departments, such as public works, public safety, health, and fire. When SARA Title III mandated Local Emergency Planning Committees, Sioux City planners recruited industry representatives to their team, until then the only piece missing in the puzzle.

Sioux City planning is team-oriented and addresses both hazardous materials and natural emergencies. A control team coordinates all efforts. And at least once each year, the team undertakes a full-

scale simulation; each month they do a tabletop exercise to work through a scenario for a possible disaster. They discuss such problems as how to handle live wires on chain link fences, what to do if nail-studded lumber halts fire engines after a tornado. All simulations, which have ranged from a school collapse to a hostage taking, are based on hazard analyses that identify potential disasters in the area.

The drills, shaped by Federal Emergency Management Agency (FEMA) training, stress an integrated team approach. The philosophy is to make exercises into learning experiences: Post-drill reviews critique the action, not the team members. Questions focus on whether planners put together a realistic scenario, whether the team was well enough trained, whether it had the resources to do the job—not whether its members performed well. Team members evaluate the administration of the drill, not the people who took part.

Finally, the plan takes political geography into account. Because Sioux City is near the Nebraska and South Dakota borders, the plan provides for cross boundary training so that the team approach to emergency management doesn't stop at the Iowa border.

For more, contact: Gary Brown, Woodbury County Emergency Services, (712) 279-6550.

Nuclear Power Emergencies

What kind of planning goes into the response to an incident at a nuclear power plant? Plans at the Minnesota Dept. of Health (MDH) give some indication of the level of detail needed.

Minnesota has two nuclear power plants. Planning for response to a nuclear emergency at these plants is coordinated by the Minnesota Dept. of Public Safety through its Division of Emergency Management (DEM). The response includes activities by state and federal agencies, local governments, local private organizations, and the power utility. The plan addresses only incidents serious enough to pose a hazard to people who live or work off-site. It doesn't address minor on-site incidents, transportation incidents involving radioactive materials, and incidents involving radioactive materials at facilities other than nuclear power plants.

State agencies involved include the departments of health, transportation, human services, agriculture, pollution control, natural resources, education, and the state patrol. Minnesota and Wisconsin also coordinate their response plans to address possible accidents at the power plant near Red Wing, Minnesota.

The Minnesota Dept. of Health's responsibility is to assess the accident and make decisions about actions to protect the public and emergency response personnel, and to assure the provision of emergency medical services. Its role is to provide trained personnel for field staff operations and the emergency operations center accident assessment office, to notify and mobilize MDH emergency responders, and to provide equipment and procedures for such emergency response functions as radiation plume monitoring and accident dose assessment. An inter-agency agreement with the DEM funds MDH's emergency response actions. For fiscal year 1992, the agreement provided about $300,000 to support MDH activities. DEM and other agencies have similar agreements.

Under the plan, field teams and the accident assessment team are mobilized when the health department receives an incident notification at the "alert" classification. The field teams meet at MDH, collect equipment and vehicles, receive their assignments, and drive to the affected area. The accident assessment team reports to the state emergency operations center at the state capitol.

The MDH field program includes monitoring teams to measure radiation levels in the environment and to collect samples. A team captain coordinates movements, sampling activities of the monitoring teams, and other field teams. A mobile radiochemical analysis team analyzes air samples for radioiodine and supplies the monitoring teams; other radionuclides are analyzed in the laboratory. County decontamination center liaisons advise local decontamination centers on monitoring and decontamination procedures for field workers, vehicles, and equipment.

The MDH accident assessment team, mobilized by telephone or through on-call pagers, reports to the state emergency operations center. The team coordinator manages MDH accident assessment and field monitoring activities. An assistant coordinator helps develop recommended protective actions and communicates with the power plant. A dose assessment analyst performs radiation dose calculations using computerized modelling, such as the RASCAL model provided by the Nuclear Regulatory Commission, and receives data on potential and actual radioactive releases from the reactor. A communications liaison keeps in touch with local officials, plots monitoring data, and maintains status boards. Public information staff explain MDH public health actions and recommendations to the media, and compose messages for the emergency broadcast system, which may advise the public to take shelter or evacuate.

Other MDH activities include radiochemical analyses, emergency medical services, assessing water and food safety, and giving guidance to emergency workers on such general issues as sanitation and safety. The MDH water supply protection program coordinates with local water supply utilities and recommends protective actions. The radiochemical laboratory analyzes samples collected by monitoring teams for radionuclide content. The results are used to guide decisions about protective actions. Finally, emergency medical services coordinate the evacuation of hospitals and nursing homes in the affected areas, and arrange the transport of patients to host facilities.

For more, contact: Raymond W. Thron, PhD, PE, Director, Division of Environmental Health, Minnesota Dept. of Health, (612) 627-5033.

RESOURCES

Addressing Post-disaster Trauma

By Jackie Little, Ouachita Parish Local Emergency Planning Committee

How do people deal with the mental pictures of destruction, injury, and death that accompany disasters?

In spring 1991, Ouachita Parish, Louisiana, population 142,000, had three major disasters in ten days: First, a flood placed over 500 homes under water; three days later, an explosion at the Angus Chemical plant left eight people dead; five days after, another flood left 2500 homes under water for five weeks.

Fortunately, the Parish has a disaster plan and, thanks to its LEPC, a strong section of the plan deals specifically with chemical emergencies. But what we hadn't planned for was the emotional crisis that disaster precipitates.

While many community groups dedicate some portion of their programs to emotional crisis support, typically for battered women, rape victims, and child abuse counseling, disaster response personnel didn't have the training to deal with the widespread emotional trauma facing them—chemical workers' memories of the explosion; flood victims' stress of weeks spent in a public shelter or fighting to keep snakes out of their living rooms.

To get help in dealing with the psychological traumas, the Parish turned to the National Organization for Victim Assistance (NOVA). NOVA responded by training local personnel in disaster crisis management, assisting in emotional debriefings, providing an intense training session for counselors that focused on the immediate crisis, and visiting the stricken communities. They provided support to citizens desperate to talk about the horrors they'd survived. They visited workers who had witnessed and experienced the explosion.

The experience made officials realize that crisis management planning too often overlooks the emotional component of trauma. Thus, to prepare the emergency response staff for emotional counseling for future disasters, the Ouachita Civil Defense Agency held a three-day workshop in November that brought together NOVA counselors and personnel from various organizations with counseling duties. The goal is to develop a Crisis Counseling Crew to respond to the emotional needs of citizens in the area.

The workshop, designed for emergency medical services and hospital staff, law enforcement officers, mental health practitioners, and clergy, covered: the nature of catastrophe; long-term stress reaction; death and dying; crisis intervention techniques; post-trauma counseling; the spiritual dimension of trauma; group debriefing techniques; coordinating community crisis response; and stress reactions to caregivers.

NOVA was founded in 1975 by people who worked with victims of crime; today, NOVA has over 3500 agencies and individuals as members, 12 staff members, and over 200 volunteer consultants. NOVA's headquarters are in Washington, DC.

For more on working with NOVA, contact: Jackie Little, Ouachita Civil Defense, 413 Natchitoches St., West Monroe, LA 71291; For more on NOVA or its crisis team, contact: North Louisiana Health Center, PO Box 1881, Monroe, LA 71210.

Cameo Portrait

Today, many emergency response planners use a computer software program called "Computer Aided Management of Emergency Operations" (CAMEO). Developed by the National Oceanic and Atmospheric Administration (NOAA) and the US EPA, CAMEO is designed to aid emergency planning and response to chemical accidents and to automate SARA Title III compliance responsibilities.

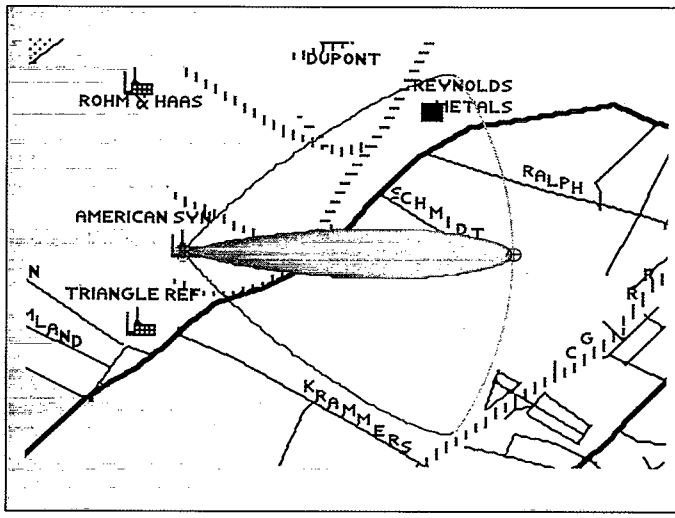
Available in both DOS and Macintosh versions, CAMEO is menu-driven, features a database of over 3300 commonly transported hazardous chemicals, over 60,000 synonyms, identification numbers, and labelling conventions. Integrated databases can track and retrieve data on facilities and their chemical inventories, chemicals in transit, shipping companies, emergency spill reports, and response resources. Software for an air dispersion model, ALOHA^{tm}, allows planners and incident commanders to estimate the area and concentration of a gas plume under various conditions. MARPLOT^{tm} software allows planners to add data on facilities, gas plumes, evacuation zones, and emergency resources to 1990 census maps of roadways, waterways, railroads, and political boundaries.

What advantages does CAMEO offer? How well does it work in practice? Here are some answers from the Disaster and Emergency Services (DES) of Louisville/Jefferson County, Kentucky, which was chosen by NOAA and the EPA as a test site for CAMEO II software.

DES administers the county's emergency response program and manages the data collected by the LEPC. Those data, according to DES technological hazards coordinator Bud Fekete, who recently reviewed CAMEO in *Firehouse* magazine, now cover 557 facilities, including 206 extremely hazardous substance (EHS) facilities, 210 non-EHS facilities, and 149 gas stations, plus 599 special populations, such as schools, nursing homes, and medical facilities. The LEPC uses the data to run vulnerability screening and develop site-specific scenarios.

CAMEO modelling has been extremely useful in alerting industrial facility managers to the size of their vulnerability zones, according to Fekete. As a result, some plants have substituted non-EHS for EHS chemicals.

DES has used CAMEO to create a series of detailed digitized maps of the city and county. Each facility is linked to the map, and the link is placed in a special computer file. An operator can access any map within one second. The maps also pinpoint the locations of schools, nursing homes, daycare centers, and medical facilities, thus allowing DES



CAMEO/ALOHA model of an anhydrous ammonia plume from a chemical plant. This model also calculates outdoor and indoor air concentrations over time for buildings downwind of the release.

Plot courtesy of Louisville/Jefferson County, Kentucky Dept. of Emergency Services.

to supply industrial plants with a list of special populations in their vulnerability zones.

In CAMEO's air dispersion modeling application, ALOHA™, DES made 52 maps for an ALOHA map file. This allows an on-scene officer to tell the computer operator that his position is on a particular page, so the operator can bring up the same map and scroll to the right section. Further, the technological hazards coordinator carries a computer, printer, and Coastal Climate's WeatherPAC-400 with a radio transmitter in his response vehicle. During an emergency, the meteorological station can be driven to the hot zone, where it sends information directly to the master computer, updating the plume every 30 seconds. ALOHA recalculates the plume, adjusting for variations in wind speed and direction, and supplies the incident commander with on-site weather data.

DES turns CAMEO II into a planning tool by developing a site-specific scenario and using the vulnerability zone developed from the scenario as the planning zone for each facility. The map shows all special populations, evacuation routes, transportation routes, and possible shelters outside the zone. Data for each facility, including building plans that show the locations of hazardous materials, utility shutoffs, private protection systems, hydrants, and so forth, can also be accessed easily.

According to Fekete, CAMEO has allowed the technological hazards coordinator to reinforce the incident commander's work. "Most ICs are delighted to be handed hard copy of an area map with the plume drawn on it," said Fekete. "The text accompanying the map, along with the chemical-specific information, gives the IC a solid foundation upon which to base decisions."

For more on Louisville/Jefferson County's experience, contact: Bud Fekete, DES, (502) 625-3646, or see the July 1991 *Firehouse* magazine. For more on CAMEO, contact: Lee Feldstein, National Safety Council, Environmental Health Center, (202) 293-2270.

Training for HazMat Response

Where can people go for training in handling chemical incidents? One source of training is the Hazardous Materials Incident Response Training Program, developed by the EPA's Emergency Response Division, Office of Emergency and Remedial Response (OERR). Program courses are designed for people who respond to emergencies or investigate and clean up abandoned hazardous waste sites. They provide training in safety and health, and in the technical operations needed to identify, evaluate, and control hazardous releases.

One of the 12 environmental courses offered by the training center is "Emergency Response to Hazardous Materials Incidents" (ERTHMI, 165.15), developed for first responders—firefighters, police officers, and EMS personnel.

During the five-day course, participants learn to recognize and evaluate a hazardous materials incident, organize a response team, protect response personnel, identify and use response resources, implement control measures, practice decision-making, and protect the public. Topics include: chemical and physical properties of hazardous materials; toxicology; recognition and identification of hazardous materials; direct reading of instruments; standard operating procedures; personnel protection and safety; and information sources.

The class emphasizes hands-on exercises in which participants wear fully encapsulating suits and chemical-splash gear and handle equipment. Attendees take part in two simulations designed to apply and test the lessons they learn. After the course, they should be able to: select appropriate personal protective equipment; use combustible gas detectors, oxygen meters, and detector tubes to evaluate hazards; use confinement and containment techniques to control hazardous material releases; identify the importance of an incident command system for effectively managing a hazardous materials incident; develop procedures for decontaminating emergency response personnel; and use situation evaluation techniques to develop strategies and select appropriate tactics for mitigating hazardous materials incidents.

To make more training available to first responders, the Emergency Response Division (ERD) permits other organizations to present the ERTHMI course. Any organization that would like to present the EPA course should have an established, recognized training program that routinely presents courses related to hazardous materials incident response. It must also have the necessary facilities, equipment, instructors, support staff, and other resources.

While the EPA can't provide funding, ERD will assist organizations in developing and implementing the courses to ensure that they meet ERD standards. ERD also provides sponsoring organizations with copies and updates of all written material and visual aids, and with such administrative materials as registration, student evaluation, and report forms. ERD or its training contractors may also be able to offer assistance in presenting courses.

For more, contact: Bruce Potoka, ERT Training Program, US EPA, (513) 569-7537.

Resources From ATSDR

A number of resources are available from the federal Agency for Toxic Substances and Disease Registry (ATSDR), a Health and Human Services Department agency created by the Comprehensive Environmental, Response Compensation, and Liability Act of 1980 (CERLCA). Under CERCLA and the Superfund Amendments and Reauthorization Act of 1986, ATSDR's mission is to prevent or mitigate human health problems and diminished quality of life resulting from exposure to hazardous substances in the environment. ATSDR is also mandated to develop information and educational programs to help health professionals evaluate, diagnose, treat, and conduct surveillance on patients exposed to hazardous substances. The agency further is involved in emergency response consultation in hazardous materials incidents.

Medical Management Guidelines for Acute Chemical Exposures (MMGACE) is a resource for health professionals who must effectively decontaminate victims, communicate with other staff, transport victims to medical facilities, protect themselves and other staff from contamination, and provide medical treatment to victims of hazardous substance emergencies. Intended for emergency room physicians, poison control centers, emergency responders, occupational health clinics, county health officials, the military, and other health professionals who must respond to acute exposure incidents involving hazardous chemicals,

MMGACE was developed under the guidance of a committee of toxicologists, occupational and emergency room physicians. It addresses the medical management of acute exposure to 25 chemicals (ranging from ammonia to xylene), management of unknown exposures, communication, triage, decontamination, transport, and protective clothing. A reference section includes information resources, antidotes, a guide to using Material Safety Data Sheets, basic toxicology, and a glossary. Available in 1992 from ATSDR's Division of Medical Education, (404) 639-6204.

Emergency Medical Services: A Planning Guide for the Management of Contaminated Patients is intended to help emergency medical services personnel plan for hazardous materials incidents. The manual can be used to help communities assess their capabilities for handling potential community hazards and to develop response plans. A companion manual, *Hospital Emergency Department: A Planning Guide for the Management of Contaminated Patients,* is intended to help emergency departments prepare for and respond to hazardous materials incidents. It, too, can be used to assess community hazards and to develop response plans. It does not offer information on medical treatment. Available from ATSDR's Emergency Response and Consultation Branch, Division of Health Assessment and Consultation, (404) 639-0616.

Other useful materials include *Case Studies in Environmental Medicine,* self-instructional educational materials that guide physicians through the diagnosis, treatment, and surveillance of people exposed to hazardous substances. The 15 case studies developed to date have been reviewed and approved by such professional associations as the American Medical Association and the American Academy of Pediatrics. A second set of 15 documents is under development. Available from ATSDR's Division of Health Education, (404) 639-6204.

Toxicological Profiles offer comprehensive information on 225 chemicals identified at hazardous waste sites. The profile of each chemical includes technical information, discussions of information gaps on the substance's toxicity and health effects, and a public health statement that can be used in communicating with the general public. Available through the Division of Toxicology and the National Technical Information Service (NTIS), (404) 639-6043.

Finally, ATSDR offers 24-hour-a-day consultation for hazardous materials emergencies at the Emergency Response and Consultation number, [(404) 639-0615], and emergency response training through the Louisville/Jefferson County Health Dept. For more information on training, contact: Emergency Response and Consultation Branch, Division of Health Assessment and Consultation, (404) 639-0616.

Aid From The CDC

The Centers for Disease Control is the lead US Public Health Service agency for coordinating and managing overall health response in major emergencies and disasters. CDC also investigates the health effects and medical consequences of natural and technological disasters.

In a major emergency, CDC alerts other appropriate federal agencies, consults with state and local agencies on identifying and finding necessary medical resources, advises federal, state, and local officials on emergency response and worker protection issues, and establishes public health surveillance. Its responsibilities include providing technical and epidemiological assistance to state and local governments before and after disasters; documenting and quantifying public health consequences of disasters; using risk factor analysis to identify potential strategies for preventing or mitigating public health effects from disasters; developing prevention programs and contingency plans; developing and maintaining national systems for acute environmental hazard surveillance; assessing health care needs immediately after a disaster; assessing health risk; and providing epidemiological and scientific support to other agencies involved in disaster planning.

To reach CDC in an emergency, call: (404) 639-0615.

Information Sources

Here are a few other sources of training, research, and information on emergency response.

The Federal Emergency Management Agency (FEMA) offers training in the integrated approach to emergency management. For more, contact: FEMA, National Emergency Training Center, Emergency Management Institute, 16825 S. Seaton Ave., Emmetsburg, MD 21727; (301) 447-1000.

The University of Delaware's Disaster Research Center (DRC) carries out research on preparation for, response to, and recovery from community-wide emergencies, including natural and technological disasters. Contact: Disaster Research Center, University of Delaware, (302) 451-6618.

Colorado State University's Hazards Assessment Laboratory facilitates interdisciplinary research on risk communication, hazard mitigation and management, and planning and preparation for emergency response. Contact: Hazards Assessment Laboratory, Colorado State University, (303) 491-7347.

The Hazard Reduction and Recovery Center at Texas A & M University studies hazard mitigation, disaster preparedness, response, and recovery. Contact: Hazard Reduction and Recovery Center, College of Architecture, Texas A & M University, (409) 845-7813.

The Natural Hazards Research and Applications Information Center at the University of Colorado is designed to strengthen communication among researchers and individuals, organizations, and agencies concerned with mitigating the effects of natural disasters. Its principal communications vehicle is the *Natural Hazards Observer,* published bimonthly, free to US subscribers and $15 to subscribers outside the US. Contact: Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado, (303) 492-6818.

The 1992 Hazardous Material Spills Conference, Philadelphia, Pennsylvania, April 21-24, will cover the latest on emergency response planning. Sponsored by the National Response Team, the National Governors' Association, the Chemical Manufacturers' Association, and the American Institute of Chemical Engineers, the conference will examine how nations, states, communities, and industries prepare for hazardous materials incidents. It will examine the effects of new legislation and offer samplers of available training programs. To register, contact: Sonja Cohen, Technical Resources, Inc.,

(301) 231-5250.

The *Chemical Manufacturers' Association* offers several public services. *CHEMTREC* (Chemical Transportation Emergency Center) provides support in hazardous materials transportation emergencies and advice in non-transportation incidents. Designed for emergency responders, carriers, and officials, it provides information on the nature of the chemical and procedures for handling spills, and notifies shippers for information and follow-up, including on-site assistance. *MEDTREC* (Medical Treatment Emergency Communications), still under development, is designed to enhance medical emergency response efforts to get usable information quickly to emergency medical and first response personnel. To reach CHEMTREC and MEDTREC, call: (800) 424-9300, 24 hours a day, seven days a week. The number is for emergency response only.

CHEMNET (Chemical Network), provides emergency response teams from chemical companies or private contractors. Designed for chemical producers who have no emergency response capability at the site of the spill, CHEMNET provides a program for responding to serious hazardous materials transportation spills. CHEMNET membership is open to chemical producers or handlers who are CHEMNET registrants. *TRANSCAER* (Transportation Community Awareness and Emergency Response) addresses community concerns about the transport of hazardous materials, helps LEPCs identify hazardous materials moving through the community, offers guidance for evaluating local emergency response plans, and assists with emergency preparedness training. For more, call CHEMTREC administration: (202) 887-1152.

The Chemical Referral Center (CRC) is designed to help the public, transportation workers, and users of chemicals to obtain health and safety information on chemicals and chemical products. Available 9-6 Eastern Time, Monday to Friday, it refers callers to state, federal, or industry representatives who can answer questions about chemicals. The number is (800) 262-8200 or (202) 887-1315.

Finally, CMA is involved in training programs. One, being developed by the Chemical Industry Council of Delaware, offers emergency room physicians general training in handling chemical emergencies. As part of its MEDTREC initiative, CMA is also working with the American Association of Poison Control Centers to develop a training package for handling medical emergency inquiries involving industrial chemicals. To be completed by summer 1992, the training package will improve poison control centers' ability to respond to emergencies involving acute occupational or accidental exposures to chemicals during their use, transport, or storage. For more on these programs, contact: Karen Creedon, CMA, (202) 887-1387.

KEEPING UP WITH IRIS

As of December 1, 1991, the Environmental Protection Agency's Integrated Risk Information System data base (IRIS) contained 491 chemicals. This included 336 oral reference dose (RfD) and 60 inhalation reference concentration (RfC) summary sections, and 205 carcinogen assessments, for a total of 601 risk information summaries. In addition, the system contains summaries of 64 chemical-specific Drinking Water Health Advisories, 187 US EPA regulatory action summaries, and complete bibliographic citations for 446 substances.

The December update replaced the oral RfD summary for silver, which had been withdrawn, and added inhalation RfC information summaries for allyl chloride, 1,2-dichloropropane, and methyl tert-butyl ether.

The risk information available in EPA's Integrated Risk Information System (IRIS) represents EPA-wide consensus positions on the potential adverse chronic human health effects of approximately 500 substances. IRIS information, on both non-cancer and cancer effects, is appropriately used when applied in the broader context of the risk assessment process outlined by the National Academy of Sciences (NAS) in its 1983 publication, *"Risk Assessment in the Federal Government: Managing the Process."* As identified and defined by NAS, the process consists of four elements: hazard identification, dose-response assessment, exposure assessment, and risk characterization. IRIS data contribute to the first two of these elements: hazard identification and dose-response assessment.

While IRIS is a useful risk information resource, it doesn't provide situation-specific information on instances of exposure. Only when IRIS data are combined with specific exposure information can they be used for characterizing the public health risks of a given chemical in a specific situation. In this context, IRIS data can aid in reaching a risk management decision designed to protect the public health. IRIS data shouldn't be construed as representing regulatory decisions.

For information on accessing IRIS, call: IRIS User Support at (513) 569-7254 or write: IRIS User Support, ECAO/EPA (MS-114), 26 West Martin Luther King Dr., Cincinnati, OH 45268.

Keeping Up With IRIS is a regular Digest feature, carried with support from the EPA's Office of Health and Environmental Assessment.

CONFERENCES & COURSES

■ *Conducting Indoor Air Quality Investigations,* Jan 14-16, St. Paul, MN. Contact: Midwest Ctr for Occup'l Health & Safety, (612) 221-3992.

■ *Demonstration Workshop of an Integrated Emergency Response,* Mar 30-Apr 2, Apr 13-16, May 11-14, Jun 8-11, Aug 31-Sep 3, Sep 21-24, Louisville, KY. Contact: Emergency Response & Consultation Branch, ATSDR, (404) 639-0615.

■ *Haz Mat Spills Conf,* Apr 21-24, Philadelphia, PA. Contact: Sonja Cohen, Technical Resources Inc, (301) 231-5250.

■ *Risk Mgmt in Env'l Health & Protection (and Quantitative Risk Assessment),* Jun 9-12, New York, NY. Contact: NYU Graduate School of Public Service, (212) 998-7432.

■ *5th Annual Nt'l Mtg & Conf of the Academy of Certified Haz Mat Mgrs,* Jun 23-25, Milwaukee, WI. Contact: Federation of Environmental Technologists, Inc., (414) 251-8163.

Next time: Report on Dioxin '91

Printed on recycled paper.