REVIEW
OF EMERGENCY RESPONSE TO CHEMICAL SPILLS AND OTHER CHEMICAL OR HAZARDOUS MATERIALS EXPOSURES FROM THE VIEWPOINT OF WORKERS' HEALTH AND SAFETY

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Prepared by
Ruth Ruttenberg & Associates, Inc.
5107 Benton Avenue
Bethesda, MD 20814
301 571-4226 -- 301 897-5848 FAX
rra@dgs.dgsys.com

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Ruth Ruttenberg

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Emergency Response to Chemical Spills and Other Hazardous Materials Exposures: A Comprehensive Overview of Resources to Protect Worker Health and Safety

This paper focuses on health and safety emergencies associated with chemical spills and other incidents that may expose workers to hazardous materials. Equally important topics which are not addressed include non-chemical accidents, first aid, work place violence, non-chemical fires and natural disasters.

The goal of this overview is to identify:

- the main activities associated with hazardous materials (HAZMAT) emergency response;
- the people most often responsible for carrying out these activities;
- requirements for HAZMAT emergency response training;
- opportunities for new HAZMAT emergency response training;
- resources to aid in actual emergencies and for use in the planning stage, to avoid or mitigate the effects of future emergencies.

Also included are suggestions made by HAZMAT and training experts on roles NIOSH might play in improving workers' ability to respond to emergencies.

I. KEY ELEMENTS OF EMERGENCY RESPONSE

Planning is required to ensure that workers' lives and health are protected in the event of a work place emergency. Key elements of emergency response include:

- development of an emergency response plan;
- training for on-site and off-site emergency responders;
- cooperative plans involving emergency responders in the community.

DEVELOPING EMERGENCY RESPONSE PLANS

When hazardous materials are handled at a work place, the Occupational Safety and Health Administration (OSHA) requires that an emergency response plan be in place (OSHA 1910.120). The plan must include evacuation and first response plans, and should also address the issue of coordination between on-site and off-site responders. A 1997 article which appeared in Occupational Health and Safety[1] cites strides made in fire education for school children, but warns that "fire education has stopped in this country... at the doorstep of industry," precisely where hazardous substances often come into play.

[1] Laford, Robert, Lt., Orange, Massachusetts Fire Department, "The Missing Cog in Fire Safety," Occupational Health and Safety, February 1997.

OSHA guidelines for preparedness include planning, training, and drills, as well as the availability of emergency equipment. Response plans for fire, chemical and weather emergencies are required by 29CFR 1910.38, 1910.120, and 1926.35. The plan, which should be reviewed by the local fire department, should identify all potential emergencies. It should be reevaluated at least annually and performance should be reviewed after each significant incident. Procedures for terminating an emergency response condition should be clearly defined. OSHA guidelines call for evacuation drills to be conducted at least once a year. One major worker safety and health risk resulting from lack of a valid response plan is that the operator who discovers a release may try to contain it without being familiar with proper procedures. Comprehensive emergency planning is needed at work sites across the country to protect workers, emergency responders and the community at large.

Among the organizations to have developed prototypes is Battelle, which offers services including emergency response program development and implementation, and emergency response drills <http://www.estd.battelle.org/dd/healthsafety.html>.

Another is the Initial Response Institute (IRI) <http://www.teleport.com/~blazing/iri/home.html>. Headquartered in Salem, Oregon, IRI provides consultation and training to industry and the fire service on handling hazardous materials and HAZMAT emergencies, fire suppression, first aid, and confined space entry/rescue. The company also provides technical services like spill response and site decontamination.

Safety Systems & Solutions, Inc., of Troy, New York, works with clients to determine the types of programs and training best suited to emergency response compliance needs <http://www.safetysystems.com/chmtrain.htm>.

TRAINING EMERGENCY RESPONDERS

When hazardous materials are present on the work site, OSHA also requires emergency response training (OSHA 1910.120). On-site responders may be a dedicated HAZMAT team or fire brigade, or, most often, collateral duty workers-who should probably never perform more than activities strictly linked to first response. The OSHA standard establishes a continuum of training requirements for emergency responders:[2]

1. At the initial level is first-responder awareness training for police personnel, security guards, night watchmen, and emergency medical personnel. The goal is to prepare these individuals to recognize hazards and to protect themselves during emergencies. Most such courses last from four to 12 hours, but there is no mandatory minimum.

[2] Seymour, T.H., "Hazardous Waste Operations and Emergency Response: A Closeup Look at Training," Job Safety and Health Quarterly, Vol.1, No.1, Fall 1989, p.21.

2. An eight-hour training course is mandatory for first-responders at the operations level who perform diking, ditching, and similar defensive activities which do not require chemical protective clothing.

3. If employees are expected to take active measures to control emergencies involving flammable liquids and gases, a minimum of 24 hours of training at the first-responder operations level is required.

4. A hazardous materials technician is trained to staff a HAZMAT or spill control team or other similar group. These individuals are trained in the use of chemical protective clothing. They must have 24 hours of training at the first-responder operations level as well as the knowledge and skills training to know, among other things:

   - how to implement the employer's emergency response plan;
   - how to properly select and use specialized chemical personal protective equipment and clothing.
   - how to implement proper decontamination procedures for hazardous substances.

5. A hazardous materials specialist generally serves as the senior member of a HAZMAT team. He or she must have at least 24 hours of training at the technician level and skills training on:

   - how to implement the local emergency response plan;
   - how to develop a site safety and control plan;
   - how to use and calibrate hazardous substance sampling instruments.

6. The on-scene incident commander, in charge of overall operations at the scene, should be a generalist with a broad knowledge of managing emergency situations. This job requires at least 24 hours of training at the first-responder operations level as well as knowledge of:

   - how to implement the employer's incident command system and emergency response plan;
   - the risks faced by those working in chemical protective clothing;
   - how to implement the relevant parts of the local emergency response plan;
   - the importance of decontamination procedures.

7. The incident commander may be assisted by skilled support personnel or specialists.

Special emergency response training for confined space rescue can be crucial in many emergencies; in similar situations, not only the original victim but also rescuers often lose their lives.

These training requirements cover a broad range of workers. See Section II below for a discussion of who needs training and Section III for groups providing HAZMAT and emergency response training.

COOPERATIVE PLANS WITH EMERGENCY RESPONDERS IN THE COMMUNITY

Cooperation and coordination between worksites and community emergency response organizations can save lives and property. In 1984 there was a fire, followed by an explosion, at the Los Angeles Texaco plant. The fire burned for 24 hours.[3] Part of one unit was destroyed and the company suffered millions of dollars in damages. At the time of the incident, there was not an adequate evacuation and emergency response plan in place. Workers tried to extinguish the flames. Afterwards, union and company officials began working together to improve emergency response and health and safety training of workers in the plant. In 1992 there was another major incident, but because of the improved training, everyone knew what to do. As a result of the planning carried out between 1984 and 1992, protective bunker gear was available; starting in 1984, monthly drills had been carried out with the local fire department, whose officers were familiar with the refinery: the firemen knew, for example, how to get additional water pressure. Injuries and damage were limited. Without the post-1984 emergency preparedness activities, a hose team of five people might well have become engulfed and lost their lives.

Although coordination can make an enormous difference in the outcome of an emergency situation, cooperation/co-training for emergency response is the exception and not the rule. In fact there are situations in which workers are not allowed to call 911during an emergency. The OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard does not require that companies make any kind of notification outside the facility. Some unions, including UNITE and OCAW, are working to correct this problem.

Often, efforts at developing cooperation involve joint training. The Teamsters Union, for example, invites fire department personnel to join its train-the-trainer programs. The union recently hired a former fire fighter as an instructor: besides bringing his expertise to the class, he reviewed and revised the training materials on the basis of his knowledge.

A coordination problem cited by some union officials interviewed for this paper is that many workers do not have access to outside telephone lines. In the EPA/OSHA report on the Lodi accident, management did not allow workers to call 911. Even when there is telephone access, the lines often connect only to company employees at the front gate.

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[3] Interview October 23, 1992 with Mr. John Siggson, Safety and Health Representative, OCAW Local 1-128, Texaco, Los Angeles plant, Wilmington, California.

II. KEY INFORMERS INVOLVED IN EMERGENCY RESPONSE TO CHEMICAL SPILLS AND OTHER HAZARDOUS MATERIALS EXPOSURES

To learn how to protect themselves and respond to hazardous situations in a way that will safeguard other workers and members of the community at large, a number of specific employee groups require emergency response training. Among those who may be called to aid in an emergency are:

- First Responders
- Paid Career Firefighters
- Volunteer Firefighters
- Emergency Medical Technicians (both paid and volunteer)
- Police Officers
- Those Who Do Containment Work
- National Guard/Reservists
- On-Site Emergency Responders
- Collateral Duty Workers
- Hospital Emergency Room and Other Medical Personnel
- Transportation Workers
- Emergency Dispatch Workers
- OSHA and Environmental Compliance Officers/Industrial Hygienists
- Other Workers in Proximity to the Emergency

First Responders need training both in what to do and in what not to do. First responders are most likely regular workers who must quickly identify hazards, report them, and activate an emergency response plan. One key area of first responder training is work place violence: homicide has become the second leading cause of job-related fatalities in the United States, accounting for 15 percent of the 6,112 fatal work injuries reported in 1996.[4] While the majority of homicides were related to robberies, there were hundreds of cases of attacks carried out by co-workers or by employees' relatives or personal acquaintances.

Paid Career Firefighters receive training through many programs offered by the International Association of Fire Fighters (IAFF) and other professional organizations. Still, their training needs remain significant, with many local fire departments unprepared to face HAZMAT emergencies: at one Massachusetts Superfund site, fire fighters refused to respond because they lacked the proper training and personal protective equipment. Training in decontamination procedures is as important as training in proper selection and use of personal protective equipment. Also important is coordinated training with personnel working in facilities that house, manufacture, or are cleaning up hazardous materials. Fire departments sited along transportation corridors -- where most HAZMAT incidents occur -- are at increased risk.

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[4] "Safety Currents," September 2, 1997, <SafetyCurrents@coastal.com>.

Volunteer Firefighters need training to respond to emergencies involving hazardous materials. Outreach to volunteer fire fighters is often more difficult because most have other full time jobs, making it hard to find times when large numbers of volunteers can attend training. Volunteer fire fighters need awareness and operations training as well as instruction on selection and use of personal protective equipment. Volunteer fire departments are sometimes unable to respond as quickly to fires involving hazardous materials because a "critical mass" of firefighters must arrive at the station from their homes or other jobs before the trucks can respond to the alarm.

Emergency Medical Technicians need training in hazardous materials emergency response, including selection and use of personal protective equipment, and decontamination procedures. There have been cases of injured or exposed individuals contaminating ambulances and hospital emergency rooms -- accidents that more training might have helped avert.

Police Officers are often first on the scene of an emergency. They need awareness training, as well as training in selection and use of personal protective equipment. To avoid alarming the public, some police officers and other emergency responders have directed evacuations without personal protective equipment, thus exposing themselves unnecessarily to serious hazards. Evacuations require planning. In rural areas, for example, a number of local police-directed evacuations have met with resistance from individuals unwilling to leave behind their livestock. Planning for such eventualities could make an evacuation both more effective and more efficient.

Those Who Do Containment Work are primarily responsible for minimizing or preventing environmental damage. They must restrict or prevent the spread of a hazardous material by stopping, slowing, or redirecting the outflow, using dams, dikes, or absorption techniques. They may isolate, divert, cover, contain, plug, and/or patch. These workers need hazardous materials emergency response training, including selection and use of personal protective equipment.

National Guard and Reservist Personnel need awareness training, preparation on how to direct evacuations efficiently and instruction on selection and use of personal protective equipment. Reservists are part of the response team efforts of the Federal Emergency Management Agency (FEMA).

On-Site Emergency Responders need to be sure their facilities have adequate emergency response and evacuation plans, including appropriate equipment. They need to ensure that drills are conducted at regular intervals and that coordination exists with off-site responders and Local Emergency Planning Committees. They require both emergency response and HAZMAT training, including training in selection and use of personal protective equipment.

Collateral Duty Workers may respond to out-of-the-ordinary chemical spills, leaks, or fires. Emergency response is not among their primary duties; they may be chemical workers, wastewater treatment workers, highway workers, or others in full-time regular duty jobs. They must ensure that their facilities have adequate emergency response and evacuation plans and that drills have been carried out to reinforce knowledge of those plans. Coordination with local off-site emergency responders is critical. They clearly need training in emergency response and HAZMAT emergencies, including selection and use of personal protective equipment. They

need to know what their training has prepared them to do -- and what it hasn't prepared them to do. The Oil, Chemical, and Atomic Workers Union, for example, trains its members, mostly collateral duty and first responders, in 24-hour operations awareness for work with hazardous materials. But the union is extremely careful to encourage trainees not to act "offensively," or in other words never to take inappropriate, aggressive measures to stem the emergency. The belief is that "a task as dangerous and difficult as emergency response should have the recognition via dedicated job description to practice and perform ER activities." When a worker believes erroneously that he or she has had sufficient training to take aggressive measures, the danger to themselves and to others is increased.

Many members of the American Federation of State, County, and Municipal Employees are collateral duty emergency responders. They are wastewater treatment workers, water treatment workers, public utility workers, road and highway workers, tollbooth workers, and bridge workers.

Hospital Emergency Room and Other Medical Personnel

Managing the medical consequences of a HAZMAT release is both complex and challenging. Unlike other accidents, here both rescue personnel and the surrounding community are at risk of contamination. Assistance may be obtained from such information sources as Poisondex (on-line), Chemtrec, poison control centers, or printed texts. For help in dealing with contaminated patients, medical personnel may call on many information sources, including the Agency for Toxic Substances and Disease Registry (ATSDR, 404-639-0615).

In the case of pesticide emergencies, a good resource is the National Pesticide Telecommunications Network, 800-858-7378, for 24-hour assistance to physicians and emergency responders. Medical on-line resources include Poisondex and Tomes Plus; some help with HAZMAT emergencies may also be provided by Medline or Toxline, accessible through "Grateful Med" software. On this topic, the American College of Occupational and Environmental Medicine sells a CD-ROM called "Silver Platter." Personnel should be trained in decontamination as well as in how and when to administer antidotes. In addition, hospital workers must be trained in infectious disease control, since appropriate controls can greatly reduce the impact of similar emergencies.

Finally, medical personnel should be involved in the development and implementation of emergency response plans, perhaps through membership in local emergency planning committees.[5]

[5] Alain Couturier and Robert McCain, "Physicians' Work in Emergency Response," Occupational Health and Safety, February 1997.

Transportation Workers

Many hazardous materials emergencies occur along transportation corridors, often in remote areas far from trained emergency responders. These incidents may endanger transportation workers (rail workers, truck drivers, barge operators, etc.), highway department workers (who often are sent to respond to spills), emergency responders, members of surrounding communities and the environment. Port workers also need specialized HAZMAT training that focuses on unique port and marine environmental issues.

Emergency Dispatch Workers

Although emergency dispatch workers are not likely to be on the front line and exposed to hazardous materials themselves, they must have knowledge of hazardous materials and clean-up techniques, so that they may quickly dispatch the proper personnel with adequate personal protective equipment.

OSHA and Environmental Compliance Officers/Industrial Hygienists

OSHA and environmental compliance officers are often called to the scene of a HAZMAT emergency. Industrial hygienists may also be present at the scene, especially when air monitoring is deemed necessary. These individuals should be trained at least to the operations level, with specific instruction on the selection and use of personal protective equipment.

Other Workers

Basic awareness training is needed by all workers who could one day find themselves in the proximity of a hazardous materials emergency. Topics that should be covered include the nature of hazards, hazard identification and first responder activities. For example, a guide developed at the University of California-Davis, lists a basic set of Emergency "Do's" and "Don'ts" that can save lives and should be known by all workers[6]. (See Appendix I.)

III. KEY SOURCES OF WORKER INFORMATION ON HEALTH AND SAFETY

There are at least three basic categories of worker health and safety information resources:

A) training information;
B) information for use during actual emergencies;
C) other public and private services, both electronic and non-electronic (Many examples of electronically available information are in Appendix V).

[6] Michael Boyle and Kurt Laptop, "Emergency Medical Response to Hazardous Materials Incidents: A Guide for First Responders Course, Student Manual," California-Arizona Consortium, University Extension, University of California, Davis, June 1, 1994, pp.38, 39.

A. TRAINING INFORMATION

Workers acquire many of their emergency response skills through training. This training is in; classrooms, simulations, and on-the-job, and it should utilize many available resources. Six main sources of training information are:

1. Training
2. On-the-job experience
3. On-line information sources
4. NIOSH Pocket Guide to Chemical Hazards
5. Department of Transportation's North American Emergency Response Guidebook
6. Material Safety Data Sheets

1. Training

Numerous emergency response training courses are offered by the public and the private sector, by for-profit and not-for-profit institutions, by universities and specialized training contractors. Most are developed to meet OSHA 1910.120 training requirements for emergency responders as mandated by the "Superfund Amendments and Reauthorization Act" (SARA). Typical offerings include an 8-hour awareness course, a 24-hour operations level training course, a 40-hour technician level training course and an 8-hour annual refresher course. The operations level course provides training required by OSHA to respond to hazardous materials emergencies with the goal of protecting people, property and the environment. Technician level training is required by OSHA for those expected to intervene aggressively to stop the release.

Training can be hands-on, classroom, on-line, with videos, or a combination. Many courses are prepackaged, and include powerpoint overheads and student workbooks. Some interactive video training on chemical and natural emergencies is available on CD-ROM. A few groups who coordinate or offer training are listed below:[7]

Sources for emergency response skill training:

- NIOSH
  The 15 Educational Resources Centers supported by the National Institute for Occupational Safety and Health offer a range of courses, but include only a few in emergency response (the 15 centers and their partner organizations are listed in Appendix II). In a 1997-98 schedule of courses,[8] only the Minnesota Educational Resource Center and the Southwest Center for Occupational & Environmental Health offered emergency response courses.

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[7] Based on available information. No criteria were used for their inclusion in this list.

[8] NIOSH, Educational Resource Centers: Schedule of Courses, September 1997-December 1998, produced by Midwest Center for Occupational Health and Safety, St. Paul, MN.

- NIEHS

Over the last 10 years, the Worker Education and Training Program of the National Institute of Environmental Health Sciences has delivered hazardous materials training to over 600,000 workers across the country. Section 126 of SARA established and funded a grant program for the training and education of workers engaged in hazardous waste removal, containment, and/or emergency response. Awardees include universities, trade unions, and labor-management consortia. (See Appendix III for a list of awardees and their subawardees.) The emergency response curricula of the NIEHS awardees is extensive, and includes:

Hazardous Materials Training & Research Institute, Iowa
"Emergency Response to Chemical Spills," 24 hours.

Hunter College, New York
"Emergency Response Health & Safety Training Course," for officers of the Fire Department of New York City, 24 hours.

International Association of Firefighters
"Hazardous Materials Training for First Responders," 24 hours.
"Surviving a Hazardous Materials Incident," 8 hours.
"Emergency Response: Your Rights and Responsibilities," 8 hours.
"Training for Hazardous Materials Team Members," 80 hours.
"Training for Hazardous Materials Response: Pesticides," 8 hours.
"Training for Hazardous Materials Response: Radiation," 8 hours.

International Chemical Workers Union
"Chemical Emergency Response," for responders to industrial chemical emergencies or workers who handle hazardous waste at treatment, storage or disposal facilities; includes dress out, plugging and patching of leaking pipes and drums, and decontamination; 32 hours.
"Train-the-Trainer: Chemical Emergency Response," 40 hours.

International Union of Operating Engineers
"Hazardous Waste Operations and Emergency Response Training," 40 hours and "Refresher," 8 hours.

Laborers-AGC Education and Training Fund
"Hazardous Waste Worker Program Supervisors Course," includes emergency response and personal protective equipment, 16 hours.

New Jersey State Police
"New Jersey HAZMAT Emergency Response Course: Level 2 Operations," for firefighters, police, emergency medical services, emergency management, health departments, public works departments, HAZMAT team members, DEP responders, and industrial fire brigade members, 8 hours.

Oil, Chemical & Atomic Workers Union

"Hazardous Substance Awareness Training," teaches site work and emergency response to employees at National Rx mail-order pharmaceutical packaging plants, 8 hours.

Service Employees Education and Support Fund

"Emergency Response Awareness Level Workbook," for road crews, waste water and fresh water treatment plant workers, and other public sector workers who may be the first on the scene at a HAZMAT emergency, 8 hours.

"Emergency Response Awareness Level Workbook," an awareness-level emergency response curriculum for hospital workers, 8 hours.

"Confined Space: Enter by Permit Only," an operations-level emergency response course for non-chemical workers, 8 hours.

United Auto Workers International Union

"Emergency Response," 8 hours

University of Alabama at Birmingham

"Hazardous Waste Site Worker Training, General Site Worker," includes emergency procedures, confined spaces and decontamination, 40 hours and "Refresher," 8 hours.

"HAZMAT First Responder-Operations Level Training," 24 hours.

"Hazardous Materials Emergency Responder-Technician Level Training," 40 hours.

"HAZMAT First Responder-Awareness Training," 9 hours.

"UAB/UPIU First Responder-Awareness Level Train-the-Trainer Year III, 16 hours.

"Confined Space Entry and Rescue Training," 24 hours.

University of California, UCLA

"Health and Safety Training Course for Hazardous Waste Workers," includes emergency planning, confined spaces, PPE and decontamination, emergency response, and hazardous release incidents; 24 hours, available in both English and Spanish.

University of California, Davis Extension

"Handling Hazardous Material Incidents: Guidelines for First Responders," 24 hours.

"Hazardous Materials Incidents at Ports, with subject matter including multi-jurisdictional response and unique environmental characteristics, 24 hours.

"Emergency Medical Response to Hazardous Materials Incidents: A Guide for First Responders," specifically for emergency medical responders for hazardous materials incidents; topics include hazardous materials recognition, isolation and notifications, the incident command system, personal protective equipment, victim rescue and decontamination, NFPA requirements, and treatment protocols; 16 hours.

"Limitations of Chemical Protective Clothing and the Role of Fitness in Combating Stress," for emergency responders trained to suit up to levels A and B, for HAZMAT team members and incident commanders, 6 hours.

University of Cincinnati

"Hazardous Waste Site Personnel," includes work on emergency response and regulations, 40 hours, and "Refresher," 8 hours.

"Hazardous Waste Site Managers and Supervisors," includes accident investigation, 8 hours.

"First on the Scene Awareness Program Industrial," focuses on skills in initial size-up of the scene, communications with other responders, and working within the emergency response plan, 6 hours.

"24-Hour Program for Industrial Emergency Responder Operations-Level," 24 hours.

"8-Hour Emergency Response Refresher Course," 8 hours.

"Municipal Emergency Response, Operations Level," designed for the municipal emergency responder who performs defensive actions at a hazardous materials incident; develops hazard recognition skills, uses personal protective equipment, SCBAs, and monitoring equipment; 24 hours.

"First on the Scene Awareness Program-Awareness," 6 hours.

"Final Rule Seminar," 3 hours.

University of Massachusetts-Lowell

"Emergency Responders Basic Health & Safety Course," designed to meet OSHA requirements for training industrial emergency response workers and workers at RCRA-licensed facilities involved in the generation, treatment, storage, and disposal of hazardous waste; topics include confined space entry and response to chemical emergencies, 24 hours.

- OSHA

The OSHA Training Institute and the 12 OSHA Training Institute Education Centers offer many occupational safety and health related courses, but while each has a course in hazardous materials, few offer emergency response. The Training Institute, in its 1997-98 schedule, offers two courses in fire protection and life safety, one on hazardous waste site inspection and emergency response for the construction industry (to be held in Beckley, WV) and one on hazardous waste site inspection and emergency response (to be held at a yet-to-be-determined location). (See Appendix IV for locations of the Institute and centers.)

- Private Institutes and Training Organizations

The California Specialized Training Institute in San Luis Obispo <http://www.csti.org/aboutcsti.html> offers a wide range of training courses, more than two dozen in the hazardous materials area. These courses include:

HM First Responder Operational

HM First Responder "Decon"

HM First Responder Operations - Nuclear, Biological and Chemical Agents

HM General Site Worker (HAZWOPER)
HM Executive Manager
HM Incident Commander
Management Techniques for HM Incident Commander
HM Principles of Environmental Crimes Investigations
HM Advanced Environmental Crimes Investigations
HM Clandestine Drug Laboratory Waste Operations
HM Clandestine Drug Laboratory Chemical Identification
HM Radiation Emergency Response
HM Emergency Medical Response to Hazardous Materials Incidents
HM Industry Technician
HM Technician - Level A-D
HM Specialist - Level F & G
HM Instructor Certification Courses Overview "Train the Trainer"
Instructor Certification
HM Instructor Certification for Trainers
HM Technician/Specialist Instructor Orientation
HM Cargo Tank Safety
HM Rail Car Safety
HM Refresher Courses
CAMEO: Computer-Aided Management of Emergency Operations
HM Technical Reference Specialist
HM Assistant Safety Officer
HM Tech Spec Terrorism.

Some colleges and universities offer programs in hazardous materials and emergency response. One example is Ohio University, Chillicotte, which offers an Associate Degree in Hazardous Materials Technology <http://www.cats.ohiou.edu/%7Echildept/Hazmat/hazmat.htm>. The program includes two emergency response courses and is designed for those who perform technical work in the environmental field, work with consulting and waste remediation firms or on emergency response teams or fire brigades for industrial sites.

Environmental Support Solutions, Inc., in Mesa, Arizona <http://www.environ.com/haz_mat2.htm> offers a number of hazardous materials corporate training courses. These include: Hazardous Materials Worker, Hazardous Materials Supervisor, Hazard Communication, HAZMAT Incidents & Community Relations, Hazardous Materials Transport, Hazardous Materials/Waste Transport, First Responder/Awareness, First Responder/Operational, Hazardous Materials Storage and Handling, Hazardous Waste Operations and Emergency Response, and Registered Hazard Control Technician.

2. On-the-job experience

All training needs to be related to the requirements of a specific job: the chemicals used and the way they are handled and processed, the equipment involved, temperatures at the work sites, the specific emergency response plan, etc. However, awareness of a number of basic rules regarding

chemicals in general is of benefit to most workers: examples are the need to store flammable liquids away from spark-producing sources, to ensure work areas are well-ventilated and that flammable liquids are stored in tightly sealed, self-closing and spill-proof containers, the need for personal protective equipment in certain situations, etc.

3. On-line information services

There are many on-line services that carry emergency response information. Many, but by no means all, are listed in Section III. While not all workers have access to on-line services, a growing number of work sites do have on-line locations. Fire department and police personnel increasingly use on-line services in their work.

4. NIOSH Pocket Guide to Chemical Hazards (See discussion in "B" below.)

5. Department of Transportation's North American Emergency Response Guidebook

This guidebook identifies health hazards, provides information about fire and explosion and suggests actions that should be taken in an emergency. It also provides tables of initial isolation distances for all directions and protective action distances based on size of spill. (See discussion in "B" below.)

6. Material Safety Data Sheets (See discussion in "B" below.)

B. INFORMATION FOR USE DURING EMERGENCIES

During an emergency, workers and emergency responders need quick access to technical information and advice. The following are some important resources which can be accessed either by telephone, by computer or in hard copy.

The Agency for Toxic Substances and Disease Registry (ATSDR) provides assistance to physicians and emergency responders dealing with chemically contaminated patients. Its emergency response number is 404-639-0615.

Chemtrec is a service operated by the Chemical Manufacturers Association. It provides information on emergency response for transportation accidents involving chemicals. Chemtrec also accesses shippers and manufacturers to get help from their on-scene experts. The 24-hour emergency telephone number is 800-424-9300. Medtrec, another service of the Chemical Manufacturers Association, provides emergency medical management information for exposures to chemical substances. It can be reached by calling the Chemtrec number.

Department of Transportation's North American Emergency Response Guidebook. The guide is for first responders during the initial phase of a hazardous materials incident. It begins with an outline for on-scene safety, suggestions of who to call for assistance and advice on how to read placards and shipping papers. Besides listing the hazards and emergency actions associated with specific chemicals, it provides tables of initial isolation and protective action distances.

Material Safety Data Sheets (MSDSs). These contain information on fire and explosion hazards, health hazards, first aid measures, reactivity, spill and leak procedures, special protection information, handling and storage. Regulatory information, ecological information, disposal and transportation information. MSDS sheets are available on the Internet, on CD-ROM, and in hard copy.

The National Pesticide Telecommunications Network provides 24-hour assistance to physicians and emergency responders dealing with patients involved in pesticide accidents. Its 24-hour telephone number is 800-858-7378.

The National Response Center should be contacted in the event of a hazardous material or petroleum release. The telephone number is 800-424-8802. If requested, the National Response Center supplies experts for on-scene assistance.

NIOSH Pocket Guide to Chemical Hazards. This widely used guide is a source of general industrial hygiene and medical surveillance information for workers, employers and occupational health professionals. For every chemical listed, the guide provides name, formula, UN or NA and guide numbers, exposure limits, physical description, chemical and physical properties, incompatibilities, measurement method, personal protection and sanitation, respirator selection recommendations, health hazard symptoms and first aid along with target organs.

The Nuclear Regulatory Commission provides assistance to emergency responders dealing with radiation accidents. Its 24-hour emergency telephone number is 301-951-0500.

Poison Control centers around the country supply advice to the public and to clinicians about emergency management of accidental chemical poisonings.

The Radiation Emergency Assistance Center/Training Site provides training courses and emergency consultation for accidents involving radioactive materials. Weekdays, from 9 a.m. to 4:30 p.m. Eastern Standard Time, the number is 423-576-3146. At other hours the number is 615-481-1000.

Software. When a hazardous materials emergency occurs, there is a need for quick access to a large amount of technical information. This information is available from several sources. Some are listed below:

The Chemical Manufacturers Association (CMA) has approved a CHEMTOX database with comprehensive information on over 10,000 chemical and hazardous substances. Included are DOT Emergency Response and Isolation Guides. The CHEMTOX RT (Regulatory/ Transportation) database includes spill and disposal information, NFPA labeling, personal protection information and regulatory data for state, federal and international bodies.

C. REVIEW OF AVAILABLE INFORMATION RESOURCES

There are many resources for gathering information on hazardous materials emergencies. Some are hard copy and some are available electronically. Below is an overview of some of these resources.

1. NON-ELECTRONIC

a. GOVERNMENT

Many government agencies have offices and divisions responsible for emergency response. Some offices provide technical information for use during emergencies, some are data sources on past emergencies.

Department of Health and Human Services (DHHS)

Agency for Toxic Substances and Disease Registry (ATSDR)

ATSDR has maintained the Hazardous Substance Emergency Surveillance System (HSESS) since January 1990.

Managing Hazardous Materials Incidents, a 3-volume series by ATSDR, gives background information for rescue personnel on pre-hospital treatment, as well as comprehensive information on specific medical management for acute exposure to the most commonly encountered chemicals.

National Institute for Occupational Safety and Health (NIOSH)

The NIOSH "Quick Guide to Chemical Hazards" is available for computer use in Windows. For chemicals found in the work environment, it features OSHA PELs, NIOSH RELs, PPE recommendations, reactivity, health hazards, routes of exposure, chemical and physical properties, measurement methods, etc.

"Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, #DHHS (NIOSH) No.l85-115, was published in 1985.

National Institute of Environmental Health Sciences

The National Institute of Environmental Health Sciences, through cooperative agreements with the Environmental Protection Agency, the Department of Energy and the Department of Transportation, administers the Worker Education and Training Program. In addition to providing training to workers exposed to hazardous materials, the awardees of this program also develop Model Worker Training Curricula. The catalogue of these curricula is soon to be available electronically on the Clearinghouse web page listed below. In hard copy, the

catalogue and the one hundred plus curricula developed by NIEHS awardees can be ordered by calling 301-431-5425. The catalogue can be viewed on-line at web site <http://www.niehs.nih.gov/wetp/clear/resource/listing2.htm>. Individual curricula may be ordered from the NIEHS Clearinghouse at cost.

Department of Labor

Occupational Safety and Health Administration

OSHA distributes a pamphlet, "Hazardous Waste and Emergency Response," (OSHA #3114, 1997) which reviews OSHA requirements for safety and health programs: work plan, site evaluation and control, site-specific safety and health plan, information and training program, personal protective equipment, monitoring, medical surveillance, decontamination procedures and emergency response. It also addresses engineering controls, handling and labeling of drums, record keeping, and sanitation of temporary workers.

Department of Transportation

Research and Special Programs Administration

The North American Emergency Response Guidebook, available in hard copy and on CD-ROM, provides initial isolation and protective action distance information, water reactive chemical information and other emergency response guidelines.

Environmental Protection Agency

Chemical Emergency Preparedness and Prevention Office

"Risk Management Programs for Chemical Accidental Release Prevention," <http://www.epa.gov/swercepp/acc-pre.html> requires development and implementation of risk management programs at facilities that manufacture, process, use, store or otherwise handle regulated substances.

Office of Emergency and Remedial Response

"The Superfund Emergency Response Program" is a citizen's guide describing the Superfund emergency response program and some of the activities performed by EPA, 1980-92, 14 pages, August 1994.

Federal Emergency Management Agency

HMTA Interagency Coordinating Group, Emergency Management Institute

Guidelines for Public Sector Hazardous Materials Training, 260 pages, March 1994. Developed under an interagency agreement with DOT, the document is the first step in a program to provide assistance and support to state, tribal, and local hazardous materials training initiatives.

Also available are emergency response plan builders to help companies customize their own emergency response plans.

b. PRIVATE

Chemical Manufacturers Association, "Handling Hazardous Materials Incidents: A Lending Library of Audiovisual Training Programs for Emergency Response Personnel," 27 pages, November 1993. The catalogue provides a listing of training programs for emergency response personnel.

Emergency Planning & Management: Ensuring Your Company's Survival in the Event of a Disaster, by William Stringfield, Stringfield & Associates, a disaster planning firm. Published by Government Institutes, this book helps companies assess the risks they run in the event of a disaster and improve their emergency preparedness, response and recovery plans. It focuses on regulatory compliance and reducing the risk of loss and includes detailed checklists to help prepare emergency management plans.

Hazardous Materials Toxicology: Clinical Principles of Environmental Health provides a detailed overview of the clinical approach to a HAZMAT release.

The National Fire Protection Association offers a number of resources on HAZMAT emergencies. These include:

"Emergency Management of Hazardous Materials Incidents"
Fire Protection Guide to Hazardous Materials
Hazardous Materials Response Handbook
Haz-Mats Wall Chart (which consolidates vital information about the fire hazards of materials)
"Haz-Mats! Case Studies for Emergency Responders" (video)
Industrial Fire Hazards Handbook
NFPA 52: "Compressed Natural Gas Vehicular Fuel Systems"
NFPA 471: "Recommended Practice for Responding to Hazardous Materials Incidents"
NFPA 472: "Standard Professional Competence of Responders to Hazardous Materials Incidents"
NFPA 473: "Standard Competencies for EMS Personnel Responding to Hazardous Materials Incidents."
NFPA Haz-Mat Wallet Card (which decodes and explains each symbol and rating)
Sax's Dangerous Properties of Industrial Materials

2. Electronic

Emergency Planning on the Internet, by emergency planning consultant Rick Tobin, was published by Government Institutes in November 1997. It focuses on emergency planning with the help of information available on the Internet.

a. Private

The International Tanker Owners Pollution Federation Limited, headquartered in London, is a non-profit organization funded by most of the world's tanker owners. It provides a range of technical services, the most important of which is responding to oil spills. ITOPF technical advisers have attended nearly 400 such spills worldwide. Its web site provides information on clean-up techniques (such as mechanical recovery of oil using booms and skimmers, the use of dispersants, the use of sorbent materials), response strategies (such as offshore recovery, shoreline cleanup, and disposal of oil and debris), and planning for oil spills (such as how to develop a contingency plan, how to approach oil spill drills and exercises, and the requirements for shipboard plans).

The Emergency Response and Research Institute (ERRI) <http://www.emergency.com/ > provides 24-hour news, information, analysis and coverage of disasters and major emergencies. Its Fire Operations page provides extra alarm reports, notification of firefighter deaths and special reports. Its EMS Operations page provides BLS, ALS, treatment and system information. The Hazardous Materials Operations Page provides chemical/biological weapons information and MSDS links. The Infectious Disease page links to CDC Weekly Reports and information about emerging infectious diseases. In two years it has been accessed more than 100,000 times.

Working Group on Community Right-to-Know (202-544-9586) <http://rtk.net>. In 1986, Congress passed the Emergency Planning and Community Right-to-Know Act (EPCRA), which established several thousand Local Emergency Planning Committees (LEPC) across the U.S. These LEPCs identify chemical hazards, plan for emergencies, convey public information and are open to all citizens. The Working Group has established a report card for LEPCs. They are judged by how well they have established goals, developed a structure and process, analyzed community hazards, carried out emergency response planning, accident prevention and risk management planning, provided information to the community and performed enforcement activities.

The World Wide Community of Emergency Services provides a directory to advertise emergency-related products and services. Also featured at the site are live chat, news groups, hot links and a message board <http://turva.me.tut.fi/cgi-bin/wilma/emema.840317920.html>.

b. Government

Department of Agriculture

Disaster Management and Coordination Staff (DMCS)

DMCS <http://www.usda.gov./da/disaster/html> coordinates emergency planning and response for the Department of Agriculture and serves as the primary contact with the Federal Emergency Management Agency and other federal departments and agencies with emergency responsibilities. The emergency structure assesses the impact of a disaster on food production, processing and distribution. Much of the work focuses on natural disaster assistance.

Department of Defense

The Department of Defense -- in conjunction with the Department of Energy, the Environmental Protection Agency, the Federal Bureau of Investigation, the Federal Emergency Management Agency and the Public Health Service -- manages the Domestic Preparedness Program (initiated in Fiscal Year 1997 as a result of the Nunn-Lugar-Domenici amendment to the FY97 Defense Authorization Act) <http://www.nbc-prepare.org/>. Emergency training associated with the program involves response to nuclear, biological or chemical contamination. A train-the-trainer model will be used to create local experts who will then train additional responders in their own communities.

Department of Energy

The Hazardous Materials Management and Emergency Response Program, associated with DOE's HAMMER Training and Education Center, assists in emergency response training for personnel at DOE facilities. <http://www.mcl.tulane.edu/cbr/hammer_home.html> The Enhanced Workforce component of the HAMMER project provides educational opportunities to prepare minorities and women for careers in Emergency Response of Waste Management. Internships at Hanford are often part of the program.

Some DOE sites have their own training web pages; for example, training schedules and documents can be obtained from Los Alamos <http://eshtraining.lanl.gov/>.

DOE and its many sites across the nuclear weapons complex often post reports on the DOE web page. Following an explosion May 14, 1997 at the Plutonium Reclamation Facility at the Hanford Site in Washington State, for example, Hanford released the "Final Report on Evaluation of the Emergency Response Organization Performance, Even Notifications, and the Occupational Health Response". The report was put on the Hanford web page <http://www.hanford.gov/safety/accident/prf_a109/doe-97-62/index.htm>.

Department of Labor

Occupational Safety and Health Administration

Two OSHA regulations relate to requirements for emergency plans for facilities that manufacture, handle, use or store hazardous materials -- 29 CFR 1910.38(a) and 1910.120 (1)(2). These rules are briefly summarized on OSHA's web page under <http://www.osha-slc.gov/OshStd_toc/OSHA_Std_toc_1910.html>.

OSHA has free Fire Safety Advisor Software available on its web page <http://www.osha.gov/oshasoft/softfirex.html>. The software gives users interactive expert help to apply OSHA's Fire Safety related standards. It addresses emergency evacuation and will prepare customized "Emergency Action Plans" and "Fire Prevention Plans."

Department of Health and Human Services

Center for Disease Control

National Center for Environmental Health, Emergency Response Coordination Group (ERCG), <http://www.cdc.gov/nceh/pubcatns/1994/cdc/brosures/emergency.htm> ERCG helps local, state, and federal agencies plan their responses to emergency situations. It also responds to requests for emergency and recovery assistance after technological disasters such as radiation leaks, chemical, or biological releases and natural disasters like hurricanes, windstorms, earthquakes, volcanic eruptions and floods.

National Institute for Occupational Safety and Health, Pittsburgh Research Laboratory, Mining Health and Safety Research, "Mine Emergency Response Interactive Training Simulation," <http://www.cdc.gov/niosh/pit/mer_merits.html>. A computer program to simulate a major mine emergency, targeted at command center personnel, is under development.

National Institute of Environmental Health Sciences

Worker Education and Training Program <http://www.niehs.nih.gov/wetp>.

NIEHS was given major responsibility for initiating a training grants program under the Superfund Amendments and Reauthoriztion Act of 1986 (SARA). The primary objective of this program is to fund non-profit organizations with a demonstrated track record of providing occupational safety and health education and developing and delivering high quality training to workers involved in handling hazardous waste or in responding to emergency releases of hazardous materials. The program has cooperative agreements with EPA, the Department of

Energy, and the Department of Transportation, as well as funding for a Minority Worker Training Program.

National Clearinghouse for Worker Safety and Health Training for Hazardous Materials, Waste Operations, and Emergency Response, <http://www.niehs.nih.gov/wetp/clear/about/about.htm>.

The National Clearinghouse for Worker Safety and Health Training for Hazardous Materials, Waste Operations and Emergency Response provides information and communication services for the NIEHS Worker Education and Training Program (WETP) and its health and safety training awardees.

Department of Interior

Office of Environmental Policy and Compliance <http://www.doi.gov/oepc/oepchome.html>

OEPC manages the Department of Interior's responses to incidents affecting natural resources and Department land and facilities during and after oil spills, hazardous materials releases, and natural catastrophes. This includes removals at hazardous materials sites under Superfund and representation of the Department on the National and Regional Response Teams.

Department of Transportation

Coast Guard

The Coast Guard <http://www.dot.gov/dotinfo/uscg/hq/g-m/nmc/response/gsa.htm> has entered into a Memorandum of Understanding with EPA and the General Services Administration to provide logistical and telecommunications support to the federal government and other National Response Team agencies supporting oil discharge or hazardous substance release response efforts through the On Scene Coordinator.

Research and Special Programs Administration

Hazardous Materials Emergency Preparedness (HMEP) grant program

HMEP provides financial and technical assistance as well as national direction and guidance to enhance state and local hazardous materials emergency planning and training <http://www.fema.gov/emi/hmep/bkground.htm>. The grant program distributes fees collected from shippers and carriers of hazardous materials to emergency responders for HAZMAT training and to local emergency planning committees for HAZMAT planning.

Hazardous Materials Information Systems

The Hazardous Materials Information Systems report materials incidents by state and by hazard class <http://ohm.volpe.dot.gov/ohm/inc_cal.htm>.

Environmental Protection Agency

EPA's Emergency Response Notification System (ERNS) is a computer data base containing information on reports of oil and hazardous substance releases that have occurred throughout the U.S. and been reported to the National Response Center, the ten EPA regions, or the U.S. Coast Guard <http://www.epa.gov/ERNS/docs/cercfact.htm>.

Oil Spill Program <http://www.epa.gov/superfind/oerr/er/oilspill/oilhome.htm>. The program provides information for preventing, preparing for and responding to oil spills. Information is also available on EPA's Spill Prevention Countermeasure and Control Plan (40 CFR 112.7), Facility Response Plan (40 CFR 112.20), and Oil Pollution Act of 1990 programs <http://www.epa.gov/region09/waste/sfund/oilpp/oil.html>.

The Superfund Emergency Response Program provides quick responses to immediate threats from hazardous substances. Emergency response actions through the program are quick, relatively low-cost activities to make sites safe for those who live or work nearby. The Region 5 web page <http://www.epa.gov/R5Super/eerbl.htm> provides the telephone number for its emergency response branch, as well as the number for the National Response Center.

Federal Emergency Management Agency (FEMA) <http://www.fema.gov/about/who.htm>

FEMA is an independent federal agency that works in partnership with other organizations that are part of the nation's emergency management system. It has a training center in Emmitsburg, MD, that trains emergency managers, supporting the nation's fire service. While primarily focused on natural disasters, HAZMAT emergencies may be covered as well. Reservists are part of the FEMA response team.

Local Emergency Planning Committees (LEPCs) and State Emergency Response Commissions (SERCs) <http://www.rtk.net/www/lepc/webpage/lepc.html>

The Emergency Planning and Community Right-to-Know Act requires each state to set up a State Emergency Response Commission. The 50 states and U.S. territories and possessions have established these commissions. The SERCs in turn designate local emergency planning districts within the state. The LEPCs initial task is to develop an emergency plan to prepare for and respond to chemical emergencies. The plan must be reviewed annually, tested, and updated. An emergency plan must

include the identity and location of hazardous materials, procedures for immediate response to a chemical accident, ways to notify the public, names of coordinators at plans and schedules for testing the plan. The plans are reviewed by the SERC. The LEPC must publicize the plan and test it through emergency drills.

National Response Center

National Response Center <http://www.nrc.uscg.mil> reports on incidents -- by government agency, by EPA region, by mode (e.g. marine, highway, pipeline, railroad, earthquake, etc.), and by incidents per year.

Postal Service

"24-Hour Health and Safety Training For Management of Hazardous Materials and Emergency Response," <http://earth2.epa.gov/program/p2dept/postal/hazmatng.html>. Postal employees on emergency response teams must have 24 hours of training annually. At a minimum the training includes hazard recognition, selection, care, and use of personal protective equipment, and safe operating procedures to be used at the incident scene.

IV. SUGGESTIONS FOR NIOSH

Use of the NIOSH Pocket Guide

The NIOSH Pocket Guide is one of the most widely used resources by workers seeking information on chemical safety and health. It would appear that for workers with higher levels of education, the Pocket Guide is a truly excellent resource. For some workers, mostly those with lower levels of formal education, using the Pocket Guide can be difficult.

One union training official suggests that NIOSH simplify the Pocket Guide. Newer editions have become larger and more complicated. Even after a week of training, it is hard for workers to use. The simpler, earlier version was easier to use. A Guide for Teaching workers how to use the Pocket Guide would be very useful, especially as more and more worker trainers are providing basic training.

Another trainer suggested that the Pocket Guide would be more effective if there was a better cross reference to the array of hazard identification numbers.

Another safety and health official has three suggestions for improving the Pocket Guide for worker use:

Include a brief explanation, in lay person's language, of medical terms used in the "Symptoms" section
Increase the size of the print

Take out the information on measurement method.

A union official representing truck drivers says that the small size of the Pocket Guide print is especially a problem for older truck drivers. Because truck drivers don't need reading glasses to drive, they often don't carry them in their trucks.

Gaps in Emergency Response Training, Awareness, and Information and How Best NIOSH Could Provide Health and Safety Training and Information to Fill These Gaps

Suggestions for NIOSH Educational Materials

Develop a few sample emergency response plans for common facilities, such as wastewater treatment plants, and disseminate them widely.

Help in the evolution of emergency response materials, many of which exist at the National Fire Academy.

Help people understand the difference between an "incidental" release and an emergency. Perhaps NIOSH could develop a set of scenarios using different commonly used (or spilled) chemicals and describe under what conditions/quantities the threshold to becoming a full-blown emergency is reached. For instance, if a 55-gallon drum of solvent (MEK or toluene) is punctured in the chemical storage area, there is an obvious emergency. But is it an emergency if the same drum falls off the fork truck in the parking lot as it is being transported between facilities? A NIOSH document could include a set of questions or criteria that one would have to consider in determining whether or not an incident constitutes an emergency. Key would be to have such a document in simple language to be sure it is useful to anyone outside of NIOSH.

NIOSH could publicize simple "Do's" and "Don'ts" for first responders.

Many of those interviewed for this paper were concerned about the wide range of workers without adequate hazardous materials and emergency response training. NIOSH could publicize a list of categories of employees—from chemical worker to firefighter, from transportation worker to water treatment worker—who could benefit from emergency response training. The critical need for plans to deal with emergency releases could also be emphasized.

Suggestions for Future NIOSH Research

If NIOSH were to become involved, research support would be best. Suggested would be a research design of descriptive studies to better define the environments in which people have to put their training to use, as well as to better evaluate the types of training they receive. What kinds of hazards do workers really face, and how often do they face them? Is the training right for the specific job? Are the emergency procedures taught both efficient and effective?

It would be helpful to develop:

- statistics to promote worker safety and health;
- statistics on the health effects suffered by workers exposed during HAZMAT emergencies;
- a catalogue of work places that have developed effective measures to deal with on-site violence.

NIOSH could sponsor additional research on the causes of injuries and illnesses associated with HAZMAT incidents to help emphasize the need to comply with the training requirements of 1910.120.

Suggestions for Other NIOSH Activities

NIOSH ERCs could consider putting greater emphasis on emergency response course offerings.

Another suggestion is for NIOSH to support/embrace the NIEHS Worker Training Program and use NIEHS training for NIOSH purposes.

NIOSH could monitor functions and responsibilities for emergency response in the industrial sector and underline the inadequacies of emergency response-in tandem with Tara O'Toole's Hazards Ahead program at DOE.

NIOSH could develop a HAZMAT Emergency Response Interactive Training Simulation parallel to the Mine Emergency Response Interactive Training Simulation currently under development.

NIOSH could help publicize the emergency telephone numbers to contact in the event of a chemical spill or similar HAZMAT emergency.

SUMMARY AND CONCLUSIONS

There is no shortage of information on emergency response to chemical spills and other chemical or hazardous waste exposures. What is in short supply is (1) adequate training for workers who may find themselves involved in hazardous materials emergencies[9] and (2) adequate knowledge of the available resources and how to access them quickly.

NIOSH, within its mandates, could continue to improve its invaluable Pocket Guide to Chemical Hazards, as well as consider new educational and research initiatives.

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[9] For guidelines and suggestions, from the literature, on quality safety and health training, see Ruth Ruttenberg & Associates, Inc., "Importance of Training for Work Place Safety and Health Programs: Preliminary Work for OSHA's Program Standard," December 1997.