4. Using the Results of a Hazards Analysis

As noted in Chapter 1, hazards analysis is a necessary first step in developing a comprehensive emergency plan; it is a decision-making process that helps planners screen and decide which facilities to plan for. After local planners have completed a hazards identification, vulnerability analysis, and risk analysis, they should develop appropriate response procedures and organize all this material into an emergency response plan. This information can also be used for the development of site-specific release scenarios for training exercises and for refining response plans. This chapter summarizes the plan contents required by Title III of the Superfund Amendments and Reauthorization Act (SARA), lists the information provided by by a hazards analysis, briefly discusses three case studies for planning purposes, and describes how computers can be helpful to the planning process. Planners should use the National Response Team's Hazardous Materials Energency Planning Guide (NRT-1) guidance document and the information generated by using this guidance to develop emergency plans for their district.

4.1 What the Plan Must Contain

Title III of SARA requires each emergency plan to include at least each of the following:

(1) Identification of facilities within the local emergency planning district (LEPD) subject to the Title III requirements; identification of routes likely to be used for the transportation of substances on the list of extremely hazardous substances (EHSs); and identification of additional facilities contributing or subjected to additional risk due to their proximity to facilities subject to Title III of SARA, such as hospitals or natural gas facilities.

(2) Methods and procedures to be followed by facility owners and operators and local emergency and medical personnel to respond to any releases of EHSs

(3) Designation of a community emergency coordinator and facility emergency coordinators, who shall make determinations necessary to implement the plan.

(4) Procedures providing reliable, effective, and timely notification by the emergency coordinators and the community emergency coordinator to persons designated in the emergency plan, and to the public, that a release has occurred.

(5) Methods for determining the occurrence of a release, and the area or population likely to be affected by such release.

(6) A description of facilities in the community subject to Title III requirements and emergency equipment at each facility in the community.

(7) Evacuation plans, including provisions for a precautionary evacuation and alternative traffic routes.

(8) Training programs, including schedules for training of local emergency response and medical personnel.

(9) Methods and schedules for exercising the emergency plan.

The information gathered in the hazards analysis will be useful in fulfilling several of these requirements, in particular (1), (4), (5) and (6). NRT-1 (page 38, Planning Element G) discusses the integration of the hazards analysis into emergency planning, and should be used as a complement to this guide. NRT-1 discusses approaches to the planning process, whether a community chooses to develop a multi-hazard

emergency operations plan (EOP) or incorporate hazardous materials planning into an existing EOP, or to develop or revise a single-hazard hazardous materials plan. Sample formats for emergency plans are outlined and planning elements are discussed in detail.

4.2 Planning Information Provided by the Hazards Analysis

As a result of the hazards analysis, the following types of information concerning EHSs should be available during the initial stages of the planning process:

- Location

(1) What facilities have EHSs

(2) What transportation routes have EHSs

- Quantity

(1) The maximum quantity likely to be released at a facility

(2) The maximum quantity likely to be transported at one time per transportation vehicle

- Potential risks

(1) Likelihood of release

(2) Consequences of release

- Other hazards to consider

(1) Whether the material is flammable

(2) Whether water can be used on it

(3) Reactivity with other materials present to form other hazardous substances and/or to release heat

(4) Likelihood of damage to property

(5) Likelihood of damage to the environment

- Emergency response information

(1) Size of the vulnerable zone in case of a release

(2) How many people are likely to be within the vulnerable zones

(3) Sensitive populations within the vulnerable zones

(4) Essential service facilities within the vulnerable zones

(5) What emergency medical procedures should be followed

(6) What specialized equipment emergency medical response personnel or local hospitals need to treat victims of exposure and whether they have such equipment

(7) Type of protective gear (clothing and equipment) needed by emergency response personnel

- Is it available at the facility?

- Is it available to emergency responders?

(8) What sampling and monitoring devices can be used to determine concentration levels

- Are such devices available?

(9) Containment/cleanup procedures

(10) What materials are needed for containment, neutralization, and cleanup

- Are these materials available?

4.3 Case Studies from Hazards Analysis

To illustrate the planning process, and the use of hazards analysis in this process, the same hypothetical releases of chlorine, ammonia, and methyl isocyanate as described in Chapter 2 (Exhibit 2-12) and Chapter 3 are used as examples. Exhibit 4-1 presents relevant data on the three example chemicals and considerations that the planning committee needs to address. This information can be used in the planning process to ensure that all needs can be accommodated should an emergency arise.

In each of the case studies, a release of a hazardous substance is possible and both the responsible party and local government must be prepared to handle the resulting hazards and associated problems. In order to respond in an effective and safe manner, local emergency responders (and private sector managers in the cases of fixed facilities such as the water treatment plant and the pesticide manufacturing plant portrayed in these case studies) must work together to create a comprehensive hazardous materials emergency plan. In order to be effective, the plan must be tested and updated at least annually and more often as needed if conditions change after establishment of the plan.

In each of the case studies, planners must first consider the safety of people within the estimated vulnerable zones. Not only must planners address evacuation but also in-place sheltering, as vapor clouds may move into populated areas too quickly to allow for a safe evacuation. Adequate warning systems must be in place to notify the public of a release. Persons who will require protection from hazardous releases include: a) people located in the immediate area of the release (plant employees in the case studies involving chlorine and methyl isocyanate, and motorists in the case of an anhydrous ammonia tank truck accident), b) people in areas threatened by hazards resulting from the released materials, and c) emergency responders. (Appendix H presents a detailed discussion on evacuation and in-place sheltering, including decision-making, planning, conducting an evacuation, sheltering of evacuees, and re-entry.)

A second planning consideration is hazard control and containment operations. Procedures for controlling and containing a hazardous release must be established and identified within the plan and exercised regularly. In each of the case studies, the hazardous material has multiple hazards associated with it. (Chlorine is poisonous, corrosive, and can act as an oxidizer; anhydrous ammonia is corrosive and can be fatal if inhaled; and methyl isocyanate is poisonous and extremely flammable.) Multiple hazards require special expertise in control and containment procedures. Regarding incidents where local government and private industry are both involved in remedial actions (such as the cases of the water treatment plant and the pesticide plant), planners must set forth provisions for cooperation between the two groups to ensure that response actions are coordinated and that direction and control are centralized.

Another key planning consideration is that of emergency medical care. Provisions must be made for on-scene emergency medical care (establishment of a triage area may be necessary), transport of victims to hospitals, and emergency room treatment. In order for this emergency care system to function properly, the hazardous materials plan should establish procedures coordinating the activities of the local emergency medical services (e.g., fire/rescue department, rescue squad, ambulance service) and local hospital(s) to ensure that victims are treated quickly and effectively.

Specialized medical supplies to treat exposures to certain chemicals should be identified during the planning process so that adequate and current supplies will be available.

Planners must address several other areas of community response as well. These include incident command; communications; search and rescue; detection, monitoring, sampling and analysis; damage assessment; cleanup; decontamination; and cost recovery. The hazardous

Exhibit 4-1

EXAMPLE HAZARDS MATRIX FOR PLANNING COMMUNITY

REEVALUATED RESULTS OF HAZARDS ANALYSIS

	Hazard A	*Hazard B*	*Hazard C*
1. RESULTS OF HAZARDS IDENTIFICATION			
a. Chemical	Chlorine	Ammonia	Liquid methyl isocyanate (MIC)
b. Location	Water treatment plant	Tank truck on local interstate highway	Pesticide manufacturing plant in semi-rural area
c. Quantity	500 lbs.	3000 lbs.	1000 lbs.
d. Properties	Health Effects: May be fatal if inhaled. Contact may cause burns to skin and eyes. Respiratory conditions may be aggravated.	Health Effects: May be fatal if inhaled. Contact may cause burns and blistering to skin and eyes. Vapors are irritating to eyes and respiratory tract.	Health Effects: May be fatal if inhaled. Skin irritant. Can cause permanent eye damage. Attacks the respiratory system and can injure lungs and bronchial airways.
	Other Hazards: Corrosive to metal (may damage structures, equipment, and vehicles). Oxidizing agent. May affect water supply (treatment plant is primary supplier). Vapors will hang close to ground level.	Other Hazards: Corrosive. Will burn under certain conditions. Vapors will initially hug the ground before rising.	Other Hazards: Extremely flammable. Odorless (in low concentrations) and colorless. Reacts violently with water. Vapors will hang close to ground level.
2. RESULTS OF VULNERABILITY ANALYSIS			
a. Vulnerable zone*	A spill of 500 lbs. of chlorine from a storage tank could result in an area of radius 1.0 miles where chlorine gas may exceed the level of concern (LOC). This is for an urban area.	A spill of 3000 lbs. of ammonia resulting from a collision of a tank truck could result in an area of radius 7.6 miles where ammonia exceeds its LOC. This is for a rural area.	A spill of 1500 lbs. of methyl isocyanate could affect an area of radius greater than 10 miles with MIC vapors exceeding the LOC. This is for a rural area assuming the liquid is hot, not diked, and at 100% concentration.
b. Population within Vulnerable zone	Total population within vulnerable zone is approximately 1250.	A total of 13,600 people in the vulnerable zone including up to 700 persons in commercial establishments or vehicles near highway interchange and seasonal influx of visitors to forest preserve in the fall.	A total of 26,700 people in the vulnerable zone including 200 workers at the plant and 1000 children in school.
c. Essential services Within zone	None	1 volunteer fire station	1 fire station and 1 police station

*The distances here may not correspond with those in NRT-1 as the assumptions used in the calculation are different.

Exhibit 4-1 (Continued)

	Hazard A	*Hazard B*	*Hazard C*
3. RESULTS OF RISK ANALYSIS			
a Likelihood of hazard occurrence	Low-because chlorine is stored in an area with leak detection equipment in 24 hour service with alarms Protective equipment is kept outside storage room	High-highway interchange has a history of accidents due to poor visibility of exits and entrances	Low-facility has up to date containment facilities with leak detection equipment and an emergency plan for its employees. There are good security arrangements that would deter tampering or accidents resulting from civil uprisings.
b Consequences if people are exposed	High levels of chlorine gas in the nursing home and factory could cause death and respiratory distress. Bedridden nursing home patients are especially susceptible. High severity of consequences However, gas is unlikely to reach a nursing home under reevaluated release conditions.	Motorists' reactions to release vapors may cause traffic accidents Injured and trapped motorists are subject to lethal vapors and possible incineration Windblown vapors can cause respiratory distress for nearby residents and business patrons High severity of consequences.	If accident occurs while school is in session, children could be killed, blinded and/or suffer chronic debilitating respiratory problems. Plant workers would be subject to similar effects at any time. High severity in school hours, medium severity at all other times
c Consequences for property	Possible superficial damage to facility equipment and structures from corrosive fumes (repairable).	Repairable damage to highway. Potential destruction of nearby vehicles due to fire or explosions.	Vapors may explode in a confined space causing property damage (repairable). Damage could result from fires (repairable)
d. Consequences of environmental exposure	Possible destruction of surrounding fauna and flora.	Potential for fire damage to adjacent forest preserve due to combustible material (recoverable in the long term).	Farm animals and other fauna could be killed or develop health effects necessitating their destruction or indirectly causing death.
e Summary likelihood/ severity of consequences	Low/High. The community would assess this on site and incident specific basis.	High/High. The community would assess this on site and incident specific basis.	Low/High to medium. The community would assess this on site and incident specific basis

EXAMPLES OF EMERGENCY PLANNING INFORMATION RESULTING FROM HAZARDS ANALYSIS

	Hazard A	*Hazard B*	*Hazard C*
Protective Equipment Needed	• Chemical-resistant clothing with full body coverage • Positive pressure, self-contained breathing apparatus	• Chemical-resistant clothing with full body coverage • Positive pressure self-contained breathing apparatus	• Chemical-resistant clothing with full body coverage • Thermal protection (in case of fire) • Positive pressure self-contained breathing apparatus
Other Equipment Needed	• Equipment to repair leaks ("Chlorine B kit") • Sampling and monitoring devices: ° Gas tube samplers and/or photoionization detectors for air ° Colorimetric kits for water • Neutralizing materials: ° Fly ash ° Cement powder ° Activated carbon ° Soda ash ° Caustic soda	• Equipment to repair leaks if possible (plugging and/or patching devices) • Sampling and monitoring devices ° Gas tube samplers ° Photoionization detectors • Neutralizing materials: ° Fly ash ° Cement powder • Vinegar and other dilute acids	• Equipment to repair leaks if possible (plugging and/or patching devices) • Sampling and monitoring devices • Alcohol foam and dry chemical agent in case of fire • Equipment for building dikes for containment: ° Heavy equipment
Cleanup of Residual Contamination	• Equipment for containing runoff (if water spray is used to knock down vapors): ° Heavy equipment (bulldozers, backhoes, dump trucks) ° Soil, sandbags, foamed polyurethane, or foamed concrete for dikes • Heavy equipment for removal of contaminated soil, pavement, containment material	• Equipment for containing runoff (if water spray is used to knock down vapors): ° Heavy equipment (bulldozers, backhoes, dump trucks) ° Soil, sandbags, foamed polyurethane, or foamed concrete for dikes	• Heavy equipment for removal of contaminated soil and pavement

SUMMARY: Information resulting from hazards analysis may identify other needs associated with warning systems; public notification; health and medical services; law enforcement; public works; and procedures for exercising the plan (see NRT-1, Chapters 4 and 5).

materials plan must address each of these areas of community response by delegating specific responsibilities to appropriate agencies of the local government. The plan also should include assistance available from regional, State, and Federal agencies as well as private industry and volunteer organizations.

In addition to addressing emergency procedures, the hazardous materials plan must also address what equipment is needed to contain and control hazardous materials spills and fires. The plan must identify the equipment, its location, how to get it to the incident scene, and how to use it safely and effectively. The most important specialized equipment that will be needed is protective gear for the emergency responders. This includes fully encapsulated chemical protective suits, thermal protection, and positive pressure self-contained breathing apparatus. In terms of equipment needed to stop a leak, specialized plugging and/or patching devices are likely to be needed, unless the opening in the damaged tank is too large to seal off. In order to keep track of hazardous material concentration levels, specialized monitoring devices will be needed. Monitoring is extremely important in the case of methyl isocyanate due to its vapors being odorless (but still highly dangerous) in low concentrations. Specialized cleanup and neutralizing materials (e g., soda ash, caustic soda, activated carbon, diatomaceous earth) likely will be needed as well. Containment equipment also must be available at the accident scene. Materials (e.g., soil, sand) and heavy equipment (e g., bulldozers, back hoes, dump trucks) likely will be used to construct dikes to contain spilled material or contaminated runoff from vapor knockdown and fire suppression operations. The heavy equipment also will be needed following the incident to remove contaminated soils and pavement. Lack of information concerning these specialized resources could make response efforts for a hazardous materials release unnecessarily difficult.

4.4 Plan Reviews in the Context of Local Resource Needs

Title III requires each planning committee "to evaluate the resources necessary to develop, implement and exercise the emergency plan" and to "make recommendations with respect to additional resources that may be required and the means for providing such additional resources."

The NRT believes that it would be very useful to have these resource evaluations and recommendations available for the Regional Response Teams (RRTs) at the time of the plan reviews. Many of the suggested plan changes may be rather modest and are not likely to require the expenditure of significant local emergency planning committee (LEPC) resources. Other changes may be more difficult to accomplish and may require substantially more resources than are available to the LEPC. RRT comments may be more useful if the RRTs can formulate them in a way that takes into consideration the LEPC's resource base. RRTs may wish to identify those suggestions for improvement that could be made with available resources and those that might require additional resources.

LEPCs may include their resource requirements in a separate section of their plans, provide information in a separate report or present requirements in a formal request for additional resources submitted to the cognizant State emergency response commission (SERC). Regardless of the method used, RRTs would be interested in information on:

- the personnel resources required by the LEPC in the preparation of the plan, including man-months of effort, and technical expertise provided and the additional resources that the LEPC would like to have available to revise and strengthen this plan;
- the financial resources required to develop the plan and the financial resources that the LEPC would like to have available in the future;
- the personnel and financial resources that would be required to exercise the plan, as proposed by the LEPC in the section on exercises; and

- the means by which the LEPC generated the resources necessary to develop the plan and the means by which the LEPC believes that the necessary additional resources could be secured.

4.5 Use of Computerized Systems in Planning

Computerized systems have many applications that would be useful to the LEPC as it incorporates hazards analysis information into a comprehensive emergency plan. They could be used for:

- Listing the facilities and the major transportation routes that handle or carry hazardous substances through the planning district and for storing and reporting chemical and hazards analysis information. This could facilitate data management associated with hazards identification.
- Modelling the release of chemicals and estimating vulnerable zones (vulnerability analysis). The system's capabilities could be restricted to the simplified methods outlined in Chapters 2 and 3 or could include a more sophisticated analysis. A further level of sophistication which considers meteorological, topographical, and other site-specific release scenario variables could also be developed according to the level of detail the local planning committee considers appropriate.
- Identifying the regulatory requirements of Title III as they relate to chemical emergency preparedness.

In addition, computerized systems could be used to provide emergency management and response information. Appendix K provides an evaluation guide in the form of a checklist for hazardous chemical inventory, planning, and response computerized systems. This checklist was developed to assist local emergency planning groups in evaluating and selecting computer systems and software that will have capabilities relevant to their environmental management and planning needs.