Guides to Chemical Risk Management

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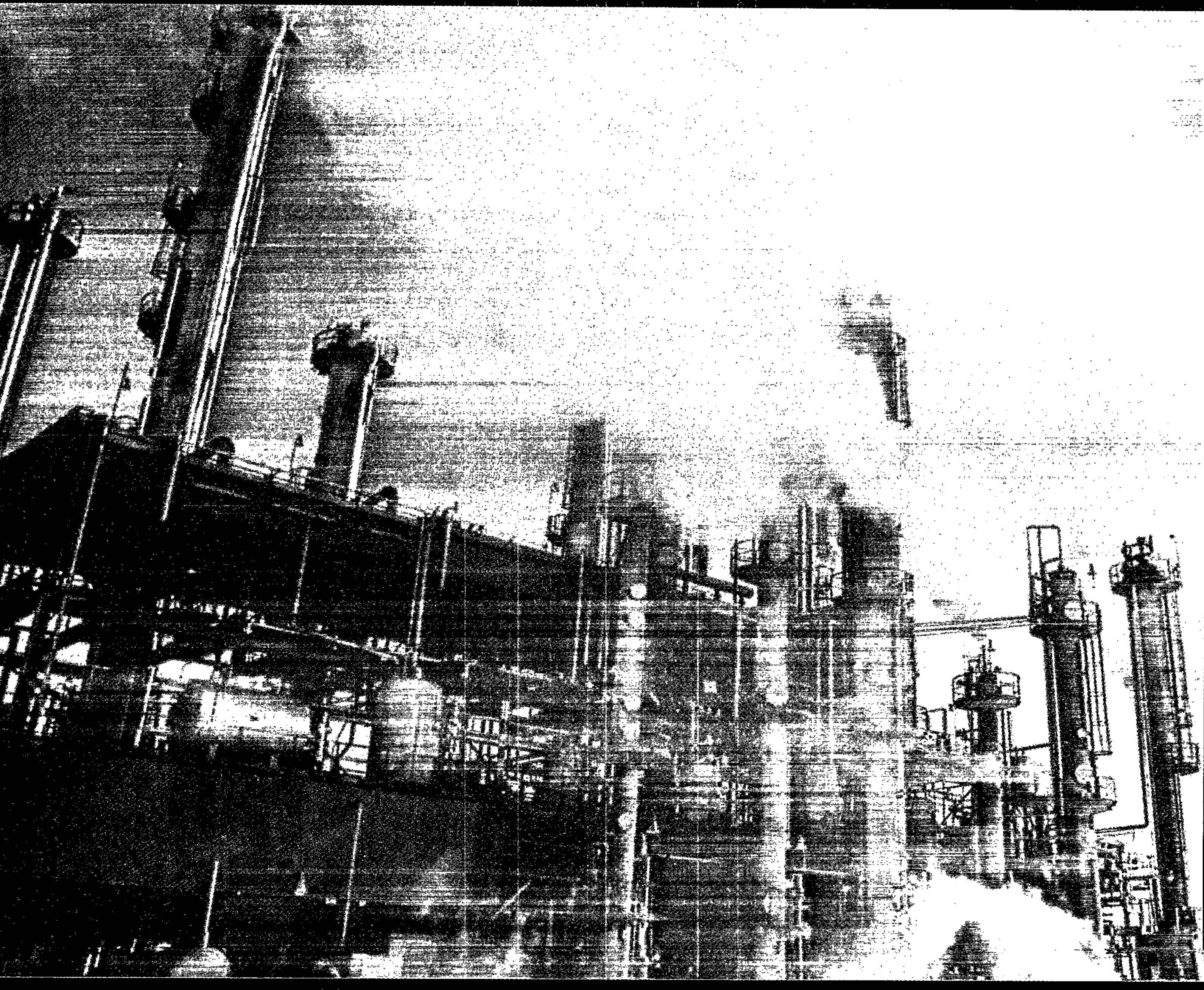
May 1999

What Makes a Hazard Hazardous:

Working with Chemical Information



The Current Status of the Risk Management Program Rule

As of the publication date of this backgrounder, key elements of EPA's Risk Management Program Rule are still not final. Public access to the offsite consequence analysis data continues to be debated. EPA has not officially decided on how it will respond to Freedom of Information Act requests. The agency has said that while the offsite consequence analysis data will not be distributed to the public on the Internet, it will supply paper copies of the data upon request. Also, EPA intends to increase the reportable quantity of hydrocarbon fuels (i.e., propane). Concurrently, the U.S. Court of Appeals granted an interim stay of the Risk Management Program Rule as it applies to facilities using propane in a process. For the most current information, see http://www.epa.gov/ceppo.

For More Information

The National Safety Council is maintaining the Chemical Emergency Management Web site at www.nsc.org/xroads.htm as a resource supplement to this series of publications. The site is a directory of Risk Management Program-related links to organizations, regulations, chemicals, rules, and regulations involved in emergency management and the safe handling of chemicals. A selection of articles and papers written about the Risk Management Program Rule and local efforts to identify and analyze risk in the community is also included. The site will be constantly expanding as industry and communities develop new information required under the Risk Management Program Rule.

Other Publications in this Series

Other documents in the Guides to Environmental Risk Management Series are listed below:

- ❑ New Ways to Prevent Chemical Incidents
- ❑ Chemical Safety in Your Community: EPA's New Risk Management Program
- ❑ How Safe Am I? Helping Communities Evaluate Chemical Risks
- ❑ Evaluating Chemical Hazards in the Community: Using an RMP's Offsite Consequences Analysis

These documents can be downloaded for free from the Chemical Emergency Management Web site at www.nsc.org/xroads.htm.

About This Document

The Environmental Health Center produced this guide under cooperative agreement CX 826604-01-0 with the U.S. Environmental Protection Agency. It is part of a series of publications on the Risk Management Program Rule and issues related to chemical emergency management.

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What Makes a Hazard Hazardous:
Working with Chemical Information

On November 17, 1998, an error at a General Chemical Corporation facility in Augusta, Georgia, resulted in the release of an airborne mixture of chemicals that included sulfur trioxide vapor. Nearly two hours passed before the county's emergency management officials were notified of the hazard. Fifty-one people in the surrounding community sought treatment for minor eye, throat, and lung irritation.

When the same process was restarted three days later, a cloud of sulfur dioxide gas was released, which was an expected part of the process. No additional notifications were required. But unexpected weather conditions kept the cloud from dispersing, as it was supposed to do. Exposure to the cloud forced 39 workers at an adjacent facility to seek medical treatment for symptoms that included shortness of breath; burning and irritation of the eyes, nose, and throat; and nausea and vomiting.

Unfortunately, chemical releases, fires, and explosions occur frequently. The Chemical Safety and Hazard Investigation Board (CSB) found that approximately 60,000 hazardous chemical releases were reported annually from 1987 through 1996. The good news is that few of these incidents resulted in injuries or deaths. The bad news is that some did (Figure 1).

Although critical reporting on controversial public health issues does not require coursework in toxicology and chemistry, some understanding of these subjects is clearly helpful. Understanding a hazard often comes down to knowing the following factors:

- ❑ A chemical's health effects
- ❑ The concentration of exposure
- ❑ The duration of exposure

Hazardous chemicals in the community are important stories. But toxicology is not a routine part of journalism school curricula. Still, a little toxicology can go a long way. Such terms as IDLH, ERPG, endpoint, risk, distance to endpoint, level of concern, and toxic concentration are tools of the trade for emergency managers in government and industry to describe the health risks associated with hazardous substances in the community. This backgrounder is a brief primer to prepare reporters working with chemical information.

The New RMP Rule

To help prevent accidents like the Augusta incidents in the future, an estimated 66,000 facilities—chemical plants, oil refineries, propane retailers, fertilizer warehouses, ammonia users, and water treatment plants—must comply with the Risk Management Plan Rule (RMP

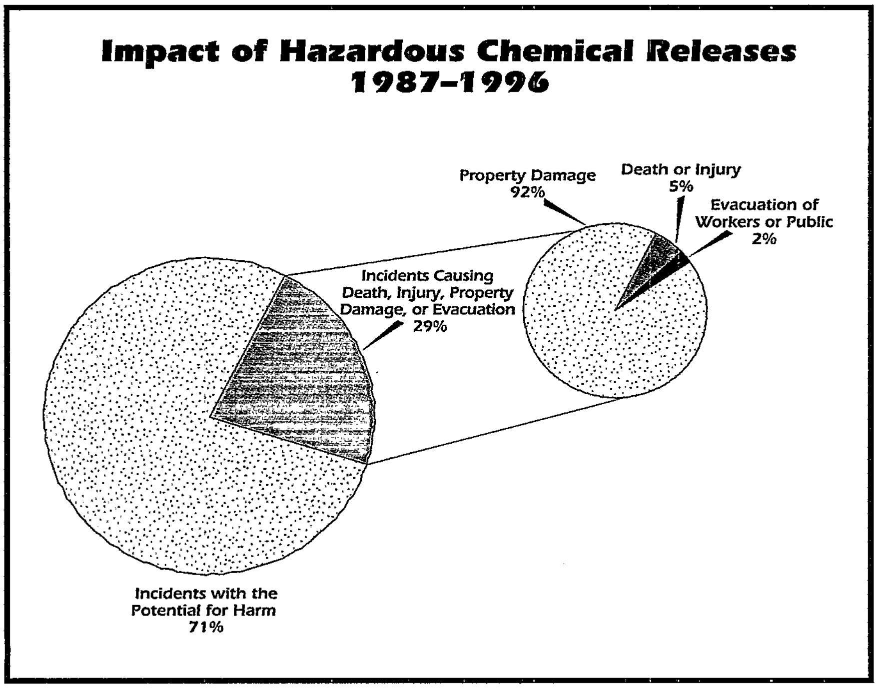

Figure 1: The Chemical Safety and Hazard Investigation Board (CSB) found that approximately 605,000 hazardous chemical releases were reported from 1987 through 1996. Of the more than 600,000 incidents that occurred in this 10-year period, about 29 percent resulted in at least one death or injury (9,705 incidents), evacuation of workers or the public (4,167 incidents), or property damage (164,082 incidents) (Chemical Safety and Hazard Investigation Board 1999).

Rule) by June 21, 1999. Facilities must file risk management plans (RMPs) with the U.S. Environmental Protection Agency (EPA) if any process at the site contains more than specified amounts of 140 hazardous substances such as propane, ammonia, or chlorine. These 140 substances include 77 toxic gases and liquids and 63 flammable gases and volatile liquids. RMPs detail information about hazards that can be caused by chemical releases and activities to prevent chemical accidents and prepare for emergencies. Much of this information will be readily available to the public.

The RMP Rule focuses on preventing accidental chemical releases, reducing risk to the community from exposure to hazardous chemicals, and minimizing the consequences of releases on the environment. The rule requires facilities to identify the hazardous chemicals they store and use, analyze the risks of these chemicals to the surrounding community, and develop emergency response plans. This information is summarized in the RMP.

Toxic or Flammable?

The RMP Rule regulates 77 acutely toxic and 63 flammable substances. All of the listed substances can form gas or vapor clouds that may travel offsite and have dangerous consequences if more than a threshold quantity is released. Though some chemicals have both toxic and flammable properties, a substance is only placed in one of the categories—the one in which the hazard is greatest. For example, sulfur trioxide is one of the 77 toxic gases and liquids governed by the RMP Rule. Although sulfur trioxide may ignite if it contacts organic or other combustible materials, its toxic properties are of greater concern. Therefore, the EPA lists it as a toxic chemical.

Hazard Versus Risk

A *hazard* is something that is capable of causing harm. The bigger the hazard, the greater the capacity to cause harm (DiNardi 1997). The hazard is based on properties intrinsic to the material and the level of exposure. Hydrofluoric acid is toxic, propane is flammable. Little can be done to change those characteristics. The severity of the hazard often depends on exposure. Exposure can be measured by the quantity of the substance released and the circumstances of the release (for example, weather conditions, topography, or mitigation measures). Exposure can be reduced, for example, by lowering the quantity of the chemical stored onsite or by implementing design improvements.

> "A *hazard* is something capable of causing harm. ... A *risk* is a measure of probability."

The hazard assessment requirements of the RMP Rule direct facilities to determine the consequences of a release of toxic chemicals outside the grounds of the facility. Once the consequences of a spill are determined, they can be used to predict how large an area will be affected by a hazardous incident. They also identify the population and sensitive environments within that area.

Risk is a measure of probability. It refers to the likelihood that an event will occur (DiNardi 1997). The greater the risk, the more likely it is that the hazard will cause harm. The likelihood is based on several variables, including the possibility of a release, the hazard created by the quantity of a chemical released, and the potential impact of the release on the public and the environment.

Ideally, risk should be quantified—for example, a 10 percent probability that a certain event will occur. Too frequently, however, the data related to rates of equipment failure and human error are unavailable, so it is not possible to reliably quantify risk. Nevertheless, we know from experience that certain events occur more frequently than other events —during transfer operations or process startups, for example. Catastrophic events, like the Bhopal tragedy, occur rarely and would be considered high-hazard, low-risk events. An incident that occurs frequently yet does not generate an offsite consequence would be considered a low-hazard, but high-risk event.

RMPs only provide information on the potential impact of a release, not the likelihood it will happen. RMPs do not quantify the probability of an event occurring because data related to rates of equipment failure and human error are usually not available.

Properties of Hazardous Substances

Property	Influence(s)
Physical State	The physical state of the substance affects its ability to move after it is released into the environment.
Vapor Pressure	Gas clouds stop forming when the leak is stopped. Liquids can continue to form a cloud after the leak has stopped, increasing exposure time.
Density	The higher the vapor pressure, the faster the chemical evaporates and the more concentrated a vapor cloud may become. Heavy gases tend to create a larger hazard. They tend to settle at ground level, increasing their contact with living things.

Recognizing Chemical Hazards

The first step in recognizing a hazard is to identify the chemical or chemicals that could be released. Identification is relatively simple when pure materials or refined, final products are involved. But identification can be more difficult if the release could occur while mixtures are undergoing reaction and several raw materials or reactive products are involved. For example, because the Augusta incidents occurred at different stages in the same chemical process, different chemicals were released by the two events.

The reaction of released chemicals may make it difficult to identify them and their hazards. For example, sulfur trioxide reacts with humidity and other water sources to create sulfuric acid. Although sulfuric acid is not regulated by the rule, it does have corrosive properties that make it dangerous.

While the RMP Rule regulates chemicals when a process contains an amount greater than a specified threshold quantity, these chemicals can also create hazards when present in amounts less than the regulated quantities. For example, sulfur trioxide is regulated by the RMP Rule when more than 10,000 pounds are present in a process. But because the Augusta site only stores a maximum of 370 pounds of sulfur trioxide, the RMP Rule would not apply.

The amount and duration of a chemical release can affect the size of the area subject to the hazard, so it is often important to be able to identify how much material is released for how long. Government representatives questioned the Augusta chemical plant's initial report of the quantity and duration of the sulfur trioxide release because a larger-than-predicted area was affected.

Variation in the chemicals released and the conditions under which they are released can affect the severity of a hazard. The sulfur dioxide release in Augusta on November 20, 1998, demonstrates some of the difficulties in recognizing and predicting hazards because it was an expected and permissible startup event. Even so, a hazard was created—39 people sought medical treatment. Although this type of release normally dissipates quickly without impact, weather conditions on that day caused the vapor cloud to settle on the ground. The event has reportedly prompted the EPA to reconsider whether maximum allowable emission levels should be lowered.

What's Hazardous—Which Chemicals and Why?

The physical state of a substance—solid, liquid, or gas—affects its ability to diffuse after it is released into the environment. All of the chemicals regulated by the RMP Rule are either gases or liquids that can evaporate quickly. Unlike solids, volatile liquids and gases can readily create large chemical clouds that can move offsite. This is what happened in the Augusta incidents. Sulfur trioxide is a volatile liquid, and because it can evaporate rapidly, it formed a vapor cloud that affected people several miles away. Sulfur dioxide is a gas, and its release formed a cloud that moved quickly into the nearby community.

Whether a released chemical is a gas or a liquid can influence the hazard it creates. A cloud is likely to be more hazardous if the community is exposed to it for a longer time. Gas clouds stop forming when the leak is stopped; however, liquids can continue to form a cloud after the leak has stopped. Without the means to control the spill, liquids can continue to evaporate, increasing the length of time a community can be exposed to its vapors. The faster a liquid evaporates, the more concentrated its vapor cloud may become. The higher the concentrations of chemical, the greater the hazard.

When choosing the chemicals to regulate, EPA considered the accident history of chemicals. Some chemicals that could be a health risk are not regulated by the RMP Rule because they are not widely used or not likely to be involved in accidents that significantly affect communities.

Measuring Evaporation

The vapor pressure value is an index of how quickly a liquid will evaporate. The higher the value, the faster the chemical evaporates. Most toxic liquids regulated by the RMP Rule have a vapor pressure of at least 10 millimeters of mercury (mm Hg) at ambient temperature, usually assumed to be 68 °F. Only two regulated toxic substances have a vapor pressure less than 10 mm of mercury. As a point of reference, the vapor pressure of water is 23 mm Hg. Sulfur trioxide has a vapor pressure of 344 mm Hg at the same temperature, indicating that it can quickly evaporate and create a cloud of a high chemical concentration.

The concentration of the chemical in a cloud is also influenced by the volume of the spill, the rate at which the release occurs, and the size of the area from which a liquid spill can evaporate.

Another important property is the density of the gas or vapor. Many gases regulated by the RMP Rule are termed heavy or dense gases because they are heavier than air. Heavy gases tend to create a greater hazard because they tend to settle at ground level, increasing their contact with living things. Air has a density of 1; sulfur dioxide has a vapor density equal to 2.26, an example of a heavy gas. High humidity at the time of the November 20, 1998, release in Augusta helped trap the sulfur dioxide gas, allowing it to sink before it could be diluted and swept away by the wind. Instead, it settled close to the release site, affecting 39 workers at the adjacent chemical plant.

Some neutrally buoyant gases are also regulated by the RMP Rule. They have densities closer to that of air, so they tend to neither float nor sink in the atmosphere. Wind and atmospheric turbulence play a large role in determining the extent to which releases of these chemicals affect communities.

Exposure and Toxicity

The human body metabolizes different toxins at different rates, and individual rates vary. When an individual's rate of exposure exceeds the body's ability to metabolize it, the toxin accumulates. When it accumulates to a certain concentration, severe injury or death may occur.

Dose is measured by the quantity of chemical to which an individual is exposed over a given period. Chemicals vary in potency or toxicity. A highly toxic chemical, such as sulfur trioxide, can cause harmful effects from exposure to a small amount in a short time. Less toxic chemicals require larger doses or longer exposure times to cause effects.

Toxic chemicals regulated by the RMP Rule are all acutely toxic, meaning they cause adverse health effects shortly after exposure. They may affect various parts of the body, resulting in several types of health effects. For example, sulfur trioxide dissolves readily in water, creating a corrosive solution of sulfuric acid. Exposure could result in eye and respiratory irritation (such as that experienced by victims of the Augusta release, skin burns, and gastrointestinal tract burns).

Toxic Endpoints

The term endpoint is used frequently in the RMP Rule. Endpoints are used when facilities and emergency planners perform offsite consequence analyses to predict areas that may be subject to hazardous substances. A toxic endpoint defines the outer boundary of a concentration considered hazardous to the community.

Most people can be exposed to an endpoint concentration for one hour without suffering irreversible health effects or other symptoms that would make it difficult for them to escape. People within the area up to the endpoint are likely to be exposed to higher concentrations. Individuals exposed to higher levels for an extended period may be seriously injured. Toxic endpoints are expressed as a concentration of the chemical in the air.

Predicting Responses to Chemical Exposure

It is difficult to predict reliably whether communities will face a hazard when they are exposed to endpoint concentrations. Though workplace exposures to

Four Methods of Predicting Responses to Chemical Exposure

Source	Agency/ Organization	Exposure Period	Population Protected	Goal
IDHL	NIOSH	30 minutes	Healthy, adult workers	Escape exposure without respirator
1/10 IDLH	EPA	30 minutes	General population	Allow the public to escape a hazardous area
ERPG-2	AIHA	60 minutes	General population	Prevent effects that could impair the ability to take protective action
TLVs	ACGIH	8 hours	Most workers	Work consistently with no harmful effects

many chemicals have been well studied, relatively little information is available about community exposure to the same chemicals.

Therefore, toxic endpoints used by the RMP Rule are often based on conclusions drawn from workplace data. The general population, more than the workforce in a facility, consists of individuals who may be more sensitive and less able to protect themselves—the very young, the very old, and the infirm.

The EPA used four different sources of information about responses to chemical exposures when they selected toxic endpoints specified by the RMP Rule:

1. Immediately Dangerous to Life and Health (IDLH). These values and their equivalents represent the most commonly used source of toxic endpoints. IDHLs were originally developed by the National Institute for Occupational Safety and Health (NIOSH) to guide employee respirator selection. Airborne concentrations above IDLH values are believed to pose a threat to healthy, adult workers who are exposed for more than 30 minutes. Excessive exposures are likely to cause immediate or delayed, permanent, adverse health effects or prevent escape from the hazardous environment. Questions have been raised about whether IDHL values can be used to protect members of the general population who may be unable to escape exposure within 30 minutes.

2. One-tenth IDLH (1/10 IDLH). This measure cuts the acceptable exposure level by a safety factor of 10 and helps to compensate for exposures longer than 30 minutes. It also compensates for potentially higher sensitivities that can be expected within the general population. The EPA's manual, *Technical Guidance for Hazards Analysis*, also known as the Green Book, helps local emergency planning committees conduct the hazard analyses required by the Emergency Planning and Community Right-to-Know Act. The Green Book recommends using the conservative, very protective 1/10 IDLH measure as a level of concern (LOC)—a threshold concentration of an airborne pollutant, usually at which a hazard to people is believed to exist.

Although emergency planners may use other values when selecting an LOC and estimating hazards created by releases, many Local Emergency Planning Committees (LEPCs) use the value of 1/10 IDLH values as the standard. Toxicologists have refined the toxic endpoints for some chemicals since the Green Book was written in 1987. EPA believes that endpoints used by the RMP Rule represent better science. Many emergency response planners will be faced with the challenge of adjusting community response plans to account for differences between RMP endpoints and the LOC values they used previously.

3. Emergency Response Planning Guidelines (ERPG). ERPGs were developed by the American Industrial Hygiene Association (AIHA). These guidelines provide three tiers that predict the range of effects from a one-hour exposure. The RMP Rule uses the second tier values, ERPG-2, as endpoints for nearly 30 toxic chemicals. ERPG-2 are tolerable-effect thresholds that represent the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action. The ERPG values estimate how the public will react to chemical exposure. Unlike many other exposure guidelines, the ERPG values do not incorporate safety factors that allow for individual differences in sensitivities; hypersensitive individuals may experience more severe effects at lower concentrations. Therefore, ERPG values are better used for emergency planning purposes, rather than serving as rigid standards for public protection.

4. Threshold Limit Values (TLVs). TLVs are the endpoints for two regulated chemicals. TLVs were established by the American Conference of Industrial Hygienists (ACGIH). These occupational exposure limits represent concentrations to which workers may be exposed repeatedly for an 8-hour shift and a 40-hour week without suffering adverse health effects. Most are intended to protect healthy male workers. Therefore, they may not be adequate for protecting the very young, the very old, and the infirm.

Dangers of Flammable Chemicals

Clouds of flammable gases or vapors are dangerous because they may result in one or more of the outcomes listed as follows:

- ❑ Vapor cloud fire (flash fire)
- ❑ Pool fire (burning of large puddles)
- ❑ Jet fire (pressurized gas or liquid escaping from a hole)
- ❑ Boiling Liquid, Expanding Vapor Explosion (BLEVE) (an explosive release of expanding vapor and boiling liquid following the catastrophic failure of a pressurized vessel holding a liquefied gas, such as propane)
- ❑ Vapor cloud explosion (a more violent flash fire)

Explosions can significantly affect communities near accident sites. Powerful shock waves may directly cause injuries and property damage. Shrapnel and structural damage created by the blast may result in additional injuries.

Fires resulting from chemical releases generally do not have an offsite effect; they are typically confined to the property where the incident occurs. Sites with potential for large fires often establish distance between the manufacturing processes that handle flammable materials and the end of the property line. That distance usually prevents fires from spreading offsite. The heat radiating from a fire may be more likely to cause injuries and property damage in the nearby community.

Flammable Endpoints

Releases of flammable chemicals do not usually lead to explosions; they are more likely to become diluted by air mixing before they can ignite. As with a car's engine, if the fuel is not rich enough, it will not ignite. If it does ignite, a fire is more likely than an explosion. Fires usually are concentrated at the facility, so

Writing a Story: Questions to Consider

Questions for Plant Managers

- ❑ What chemicals do you have onsite that can cause injuries to the public? What dangerous chemicals do you have onsite that are not listed in the RMP regulation? Can you supply an MSDS or other chemical hazard information?
- ❑ How dangerous are these chemicals? Are they toxic, flammable, or explosive?
- ❑ How reactive are these chemicals to water, heat, or other substances? Could this reactivity result in an explosion or exposure to an even more dangerous chemical?
- ❑ Have toxicity or exposure studies been conducted on these chemicals? Have these studies been verified by credible scientists?
- ❑ What are you doing to reduce hazards? For example, reducing chemical inventories, substituting less hazardous chemicals, improving process design, providing training and management controls.
- ❑ Are the endpoints you use for your worst-case and alternative scenarios adequate to protect the public?

Questions for the LEPC

- ❑ Have you obtained documentation of the chemicals onsite from EPCRA and other regulatory filings? Are the documents consistent with the RMP?
- ❑ How does the RMP hazard assessment compare with the worst-case scenario developed by the LEPC?

people who are within a half-mile or less face the greatest danger if an accident occurs.

The RMP Rule specifies that three endpoints may be considered when analyzing release scenarios for the 63 flammable gases and volatile liquids regulated by the RMP Rule:

1. Increases in air pressure resulting from a vapor cloud explosion. This endpoint must represent an increase in air pressure by 1 pound per square inch (psi). A 1 psi pressure increase is intended to be conservative. It does not define a level at which severe injuries or death would be expected. Though a 1 psi shock wave will not cause direct injury, it will break windows and may cause other property damage that could result in injuries. Some people within an area exposed to a 1 psi overpressure may be hurt, but not everyone. Because glass shards and other shrapnel from an explosion may travel a distance greater than the 1 psi shock wave, it is possible for injuries to result beyond the 1 psi endpoint.

2. Radiant heat of 5 kilowatts/meter^2 (kw/m^2) for 40 seconds resulting from a fireball or pool fire. Human skin exposure to radiant heat of this intensity for more than 40 seconds causes second degree burns or blisters, at a minimum.

3. A chemical's lower flammability limit (LFL). The LFL represents the minimum percentage of flammable chemical in air that must be present for ignition to occur. When a gas or vapor is diluted to a concentration below its LFL endpoint, it can no longer create a fire hazard.

Annotated List of Accident Prevention References and Links

References and links to documents or Internet sites should not be construed as an endorsement of the views contained therein.

Federal Information

EPA's Chemical Emergency Preparedness and Prevention Office
http://www.epa.gov/ceppo

EPA's web page for Chemical Accident Prevention and Risk Management Planning provides very useful, comprehensive information. Examples of available information include fact sheets, questions and answers, newsletters, links to non-EPA sites, the Clean Air Act section 112(r) legislation, the List of Regulated Substances and Thresholds for Accidental Release Prevention, the Risk Management Program Rule regulations, technical guidance documents, and many other resources. EPA will maintain an online database of all RMPs—in RMP*Info. However, RMP*Info will not contain the OCA data. The site links to free RMP*Comp software that identifies the size of the geographic area that may become hazardous following an incident.

Introduction to the Accidental Release Prevention Program is available at the following URL: http://www.epa.gov/ceppo/pubs/hotline/caa.html

EPA's Resource Conservation and Recovery Act, Superfund, and EPCRA Hotline
http://www.epa.gov/epaoswer/hotline

This site provides information on how to contact the EPA-sponsored Hotline that addresses the Risk Management Program Rule. Other information resources are also provided. Many related documents, including those listed on the EPA site above, can be ordered by calling (800) 424-9346 or (703) 412-9810 in the Washington, D.C., area.

The National Oceanic and Atmospheric Administration (NOAA) Office of Response and Restoration
http://response.restoration.noaa.gov/index.html

NOAA's Office of Response and Restoration Web site provides tools and information for emergency responders and planners. The Chemical Reactivity Worksheet (http://response.restoration.noaa.gov/chemaids/react.html) is a free program that provides reactivity information for more than 4,000 common hazardous chemicals.

EPA's Emergency Response Notification System (ERNS)
http://www.epa.gov/ERNS/

ERNS is a database of information on notifications of oil discharges and hazardous substances releases. It is a cooperative data sharing effort among EPA, the Department of Transportation, and the National Response Center.

Chemical Safety and Hazard Investigation Board (CSB)
http://www.chemsafety.gov

The Chemical Safety and Hazard Investigation Board Web site has information about incidents investigated by the board, as well as a library of chemical safety documents and information on the year 2000 issue.

National Response Center
http://www.nrc.uscg.mil

The National Response Center serves as the sole point of contact for reporting all oil, chemical, radiological, biological, and etiological discharges into the environment anywhere in the United States and its territories. Summary statistics on chemical accidents are available on the National Response Center's Web site.

Nonprofit Organizations

National Safety Council
http://www.nsc.org/xroads.htm

The Environmental Health Center's Crossroads Chemical Emergency Management page is designed to expand and strengthen the network of organizations involved in emergency planning and response, chemical safety, and hazardous chemical rules and regulations. This Web page will continually evolve to feature a comprehensive risk communication repository focusing on the Risk Management Program Rule. Additional useful resources not included in this document can be found at this Web site.

Journalism

Meghan Gourley and others at the *Augusta Chronicle* wrote about two releases of toxic chemicals from one chemical plant that affected the surrounding community on November 18 and 21, 1998. These stories illustrate community concern over local hazards, and factors that impact risk. Some of these articles are listed below. Reporters at the *Chronicle* can be reached at (800) 622-6358, Meghan Gourley at x3227 and Robert Pavey at x119. E-mails for these reporters are Meggit@hotmail.com and Rpavey@augustachronicle.com.

- Chemical Spill Concerns School Officials, http://www.augustachronicle.com/stories/112098/met_COL-2409.001.shtml
- School leader Denies Findings of EPA Report, http://www.augustachronicle.com/stories/081598/met_COL-6845.001.shtml
- Latest Release Stirs school Location Debate, http://www.augustachronicle.com/stories/ll2198/met_gas3.shtml
- Reports Show Plant Has History of Slow Notification, http://www.augustachronicle.com/stories/112198/met_gasl.shtml

Documents

The 600K Report: Commercial Chemical Incidents in the United States, 1987–1996
http://www.csb.gov/1999/news/n9916.htm

Chemical Safety and Hazard Investigation Board. 1999. *The 600K Report: Commercial Chemical Incidents in the United States, 1987–1996.*

Technical Guidance for Hazards Analysis: Emergency Planning for Extremely Hazardous Substances
http://www.epa.gov/ncepihom/nepishom/ (search on document number OSWER880001)

EPA, Federal Emergency Management Agency, U.S. Department of Transportation. 1987. Technical Guidance for

Hazards Analysis: Emergency Planning for Extremely Hazardous Substances. Document Number OSWER880001.

Exposure Guidelines
http://www.nsc.org/xroads.htm

Nir Barnea. 1997. "Exposure Guidelines." *CAMEO Today*, 7 no. 5, July/August 1997.

The Occupational Environment: Its Evaluation and Control

DiNardi, S.R. 1997. The occupational environment: Its evaluation and control. *AIHA*.

Material Safety Data Sheets (MSDSs)
http://www.nsc.org/xroads.htm

MSDSs are valuable sources of information about a chemical's physical and chemical characteristics, fire and explosion hazards, and health hazards. The Emergency Planning and Community Right-to-Know Act requires regulated facilities to submit copies of MSDSs to their Local Emergency Planning Committee, which can distribute copies to the public. The Chemical Crossroads Web site of the National Safety Council's Environmental Health Center provides easy access to several Internet sources of MSDSs. Information about specific hazardous chemicals can be also be found at the EHC Web site http://www.nsc.org/ehc/ew/chemical.htm. In addition, EPA's Chemical Emergency Preparedness and Prevention Office has a Web page (http://www.epa.gov/swercepp/cheminf.html) that provides access to online information about hazardous chemicals.

Organizational Contacts

U.S. Environmental Protection Agency

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The Environmental Health Center (EHC) is a division of the National Safety Council, an 85-year-old nonprofit, nongovernmental organization. The National Safety Council is a national leader on accident prevention and home, workplace, auto, and highway safety issues.

The National Safety Council established EHC in 1988 to undertake environmental communications activities aimed at helping society and citizens better understand and act knowledgeably and responsibly in the face of potential environmental health risks. Since that start, EHC has built a strong record of effective, nonpartisan communication on environmental health risks and challenges.

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