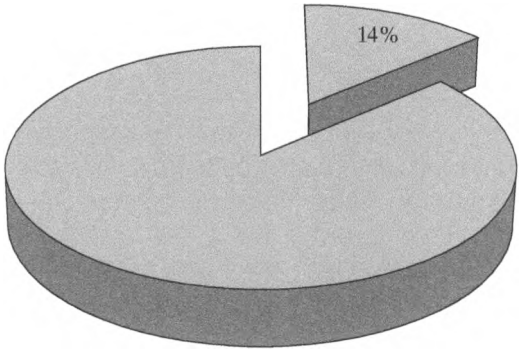
CHAPTER 5

# Information Systems




***Percentage of OSHA General Industry citations addressing this subject.***

There are two schools of thought regarding responsibility for risk in the workplace. The more ambitious of these two factions places full responsibility on the employer, not only to identify hazards but also to eliminate them so that the employee is assured a safe and healthful workplace regardless of the nature of the hazard. For the most part, this is the approach used by the drafters of the OSHA law. It is true that the law contains a general-duty clause for employees as well as employers, but there is no question that the enforcement provisions of the law are to confirm compliance on the part of the employer, not the employee.

The second of these schools of thought is more conservative in that it recognizes the inability of the employer to completely eliminate some hazards and accordingly shifts some of the responsibility to the employee by requiring the presence of information systems that provide the employee with data specifying the nature and degree of hazard associated with the job. The theory of this school of thought is that the employee is thus given the necessary data with which to evaluate the risks and take action accordingly.

As OSHA entered its second decade of existence, it increasingly shifted toward this more conservative approach, reflecting the more conservative political climate that was ushered in by the change in government administrations in the United States in 1980. Even OSHA's critics acknowledged the fairness of a system of disclosing knowledge to employees of hazards to which they would be exposed and of which the

employer had knowledge. Thus began the movement that became known as the *right-to-know* movement, along with regulations requiring Safety Data Sheets (SDSs) and labeling for hazardous materials to which employees or the public might be exposed.

Although more conservative in concept, the right-to-know movement should not be interpreted as a weakening in the protection of the rights of the worker to a safe and healthful work environment. To the contrary, knowledge of the hazards can be a potent weapon in the employee's fight for improved safety and health; often, the employer is aware of this power in the hands of the employee. The specter of future litigation for today's hazards is a powerful motivator for careful concern on the part of the employer, especially if the company is large and can be shown by attorneys to have a "deep pocket." Despite the immunities provided by workers' compensation laws, employers are increasingly exposed to litigation risk as a result of exposing employees and others to hazards. Further, information systems that proliferate knowledge of these hazards heighten that risk.

## HAZARD COMMUNICATION

Action in the right-to-know movement was precipitated by OSHA in late 1983 with the promulgation of the hazard communication standard (29 CFR 1910.1200, 1983). A significant provision of this standard was the requirement that manufacturers and importers must label containers that they ship and provide an MSDS for each hazardous chemical they produce or import. Employers in industries who make use of the hazardous substances also have responsibilities to maintain hazard communication programs to protect their employees. Since then, there have been two revisions to the standard, one in 1992 and another in 2012. The 1992 standard was focused on hazard determination and allowed manufacturers a great degree of latitude in determining what was in the MSDS and how it was presented. In order to drive a more coherent standard of hazard communication, OSHA adopted the Globally Harmonized System (GHS) in 2012. The GHS, as its name implies, is a global standard similar to the metric standard of measure. The United Nations first proposed a global system in 1992 and the first edition of the GHS was published in December 2002. There has been a subsequent revision every two years and as of 2016, 72 countries had adopted it as a standard (United Nations Historical Background of GHS, © 2016 United Nations. Reprinted with the permission of the United Nations). With the adoption of the GHS, MSDS have been replaced by Safety Data Sheets (SDS). The GHS addresses several needs of the previous standard (SCHC, 2012):

- Harmonized definitions of hazards
- Standardized labeling
- Harmonized format for SDS

Additionally, the GHS's pictogram format is anticipated to drive increased comprehension. In total, OSHA believes that there will be a 7x return on the conversion from injury cost avoidance and productivity improvements (Facts on Aligning the Hazard Communication Standard to the GHS, 2016). Hazard communication programs should be considered very important, as a large amount of OSHA inspection activity across all industries continues to center upon this facet of worker safety and health.

## Hazard Classification

Rather than determining hazards (as the previous standard did), GHS uses a system of hazard definitions to classify hazards. Using these classifications, the hazards are then communicated uniformly through the standardized SDS elements. This then provides the opportunity to develop systems to control exposure to the hazards. This tiered approach is depicted in Figure 5.1. As can be seen, the process starts with classification of hazards since the standardized nature allows much easier communication.

GHS classifies hazards into major categories (examples of hazards are not to be considered an exhaustive list):

- Health Hazards: acute toxicity, carcinogenicity, and simple asphyxiants
- Physical Hazards: explosive, oxidizing gas, pyrophoric liquids, and combustible dusts

GHS has a fairly exhaustive list of subclassification for these hazards. These are included in the appendices for 1910.1200 as Appendix A (Health Hazards) and B (Physical Hazards). A joint alliance by OSHA and the Society for Chemical Hazard Communication (SCHC) utilized these appendices to create two tables (one for health and one for physical) of hazard classifications. These are provided in Figures 5.2 and 5.3 and the reader is encouraged to use them in Case Study 5.1 and several of the end-of-chapter questions to verify understanding. **Please note, column categories should be considered independent**


**FIGURE 5.1**

GHS Classification and Communication Elements.

## Physical Hazards

| Hazard Class | Hazard Category | | | | | | |
|---|---|---|---|---|---|---|---|
| | *Category 1* | *Category 2* | *Category 3* | *Category 4* | *Category 5* | *Category 6* | *Category 7* |
| Explosives | Unstable Explosives | Div 1.1 | Div 1.2 | Div 1.3 | Div 1.4 | Div 1.5 | Div 1.6 |
| Flammable Gases | 1 | 2 | | | | | |
| Flammable Aerosols | 1 | 2 | | | | | |
| Oxidizing Gases | 1 | | | | | | |
| Gases under Pressure<br>Compressed Gases<br>Liquefied Gases<br>Refrigerated Liquefied Gases<br>Dissolved Gases | 1 | | | | | | |
| Flammable Liquids | 1 | 2 | 3 | 4 | | | |
| Flammable Solids | 1 | 2 | | | | | |
| Self-Reactive Chemicals | Type A | Type B | Type C | Type D | Type E | Type F | Type G |
| Pyrophoric Liquids | 1 | | | | | | |
| Pyrophoric Solid | 1 | | | | | | |
| Pyrophoric Gases | Single category | | | | | | |
| Self-heating Chemicals | 1 | 2 | | | | | |
| Chemicals, which in contact with water, emit flammable gases | 1 | 2 | 3 | | | | |
| Oxidizing Liquids | 1 | 2 | 3 | | | | |
| Oxidizing Solids | 1 | 2 | 3 | | | | |
| Organic Peroxides | Type A | Type B | Type C | Type D | Type E | Type F | Type G |
| Corrosive to Metals | 1 | | | | | | |
| Combustible Dusts | Single category | | | | | | |

**FIGURE 5.2**

Physical Hazard Classification per GHS guidelines (used with permission, SCHC—Hazard Communication, 2012).

**from one hazard class to another**. For the criteria behind each hazard class category, the reader is encouraged to refer back to the actual standards. Using the Flammable Liquids hazard classification in CFR 1910.1200 Appendix B6.2, for example,

- Category 1 has a flashpoint of less than 73.4°F and an initial boiling point of less than or equal to 95°F
- Category 2 has a flashpoint of less than 73.4°F and an initial boiling point greater than 95°F
- Category 3 has a flashpoint of greater than or equal to 73.4°F and less than or equal to 140°F
- Category 4 has a flashpoint greater than 140°F and less than or equal to 199.4°F

Flammable liquids are one of the many hazard classifications that can be seen summarized in Figure 5.2.

## Health Hazards

| Hazard Class | Hazard Category | | | |
|---|---|---|---|---|
| | *Category 1* | *Category 2* | *Category 3* | *Category 4* |
| Acute Toxicity | 1 | 2 | 3 | 4 |
| Skin Corrosion/ Irritation | 1A | 1B | 1C | 2 |
| Serious Eye Damage/ Eye Irritation | 1 | 2A | 2B | |
| Respiratory or Skin Sensitization | 1 | | | |
| Germ Cell Mutagenicity | 1A | 1B | 2 | |
| Carcinogenicity | 1A | 1B | 2 | |
| Reproductive Toxicity | 1A | 1B | 2 | Lactation |
| STOT – Single Exposure | 1 | 2 | 3 | |
| STOT – Repeated Exposure | 1 | 2 | | |
| Aspiration | 1 | | | |
| Simple Asphyxiants | Single Category | | | |

**FIGURE 5.3**

Health Hazard Classification per GHS guidelines (used with permission, SCHC—Hazard Communication, 2012).

### GHS Pictograms

Each of the hazard classifications is given a pictogram to convey the danger visually. These pictograms and their associated hazard classifications can be found in Figure 5.4. These pictograms are mandated for the updated requirements on container labeling. This consistent approach should help to mitigate language and understanding barriers. As can be seen in Case Study 5.1, the process is fairly straightforward in classifying the hazard, determining the category, identifying the pictogram, and determining the keyword.

**CASE STUDY 5.1**

A chemical mixture contains sodium hypochlorite and sodium chloride. Lab tests have determined that the dangers of the chemicals are skin irritation and serious eye damage. As part of section 2 for the SDS, these hazards should be classified as "skin irritant" category 2 and "serious eye damage" category 1. "skin irritant" category 2 means there will be inflammation on the skin during testing, but no corrosive effects as might be seen with 1A through 1C. "serious eye damage" category 1 means irreversible damage to eyes has occurred on tests whereas 2A and 2B indicate a degree

of irritation which is fully reversible. Therefore, the pictogram of corrosive is used on the label with a keyword of danger due to the rating of category 1 for "serious eye damage." If it was 2A or 2B it would only be a warning. The appropriate label from Appendix C of the standard is given in Figure 5.5.

| GHS Pictograms and Hazard Classes | | |
|---|---|---|
| Health Hazard<br>  <br>• Carcinogen<br>• Mutagenicity<br>• Reproductive Toxicity<br>• Respiratory Sensitizer<br>• Target Organ Toxicity<br>• Aspiration Toxicity | Flame<br>  <br>• Flammables<br>• Pyrophorics<br>• Self-Heating<br>• Emits Flammable Gas<br>• Self-Reactives<br>• Organic Peroxides | Exclamation Mark<br>  <br>• Irritant (skin and eye)<br>• Skin Sensitizer<br>• Acute Toxicity (harmful)<br>• Narcotic Effects<br>• Respiratory Tract Irritant<br>• Hazardous to Ozone Layer (Non-Mandatory) |
| Gas Cylinder<br>  <br>• Gases Under Pressure | Corrosion<br>  <br>• Skin Corrosion/Burns<br>• Eye Damage<br>• Corrosive to Metals | Exploding Bomb<br>  <br>• Explosives<br>• Self-Reactives<br>• Organic Peroxides |
| Flame Over Circle<br>  <br>• Oxidizers | Environment (Non-Mandatory)<br>  <br>• Aquatic Toxicity | Skull and Crossbones<br>  <br>• Acute Toxicity (fatal or toxic) |

**FIGURE 5.4**

GHS Pictograms and Hazards.

## Container Labeling

While the GHS specifies the label format and parameters (see Figure 5.5), the hazard communication standard places the labeling responsibility on the manufacturer or importer of the substance. Just about any container one can think of is included, except

**C.4.5 EYE DAMAGE/IRRITATION**
**(Classified in Accordance with Appendix A.3)**

| Hazard category | Signal word | Hazard statement | Pictogram |
|---|---|---|---|
| | | | Corrosion |
| 1 | Danger | Causes serious eye damage |  |

Precautionary statements

| Prevention | Response | Storage | Disposal |
|---|---|---|---|
| **Wear eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment. | **If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor/ . . .** . . . Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. | | |

**FIGURE 5.5**

Approved GHS Label for a Chemical with Hazard Classification "Serious Eye Damage" Category 1 (CFR 1910.1200 Appendix C).

pipes; the labeling of pipes is the concern of other OSHA standards. The labeling of some substances is governed by rules administered by another regulatory agency. For this and other reasons, some substances are excluded from the OSHA requirement, as follows:

- Pesticides
- Food, drugs, or cosmetics
- Alcoholic beverages
- Substances covered by the labeling requirements of the Consumer Product Safety Commission (CPSC)
- Hazardous wastes
- Tobacco or tobacco products
- Wood or wood products
- "Articles"

The term articles is to be interpreted as manufactured items that are formed to a specific shape or design during manufacture, with the end use being dependent on that shape or design, and that do not result in hazardous chemical exposures during normal use. The distinction really is whether the item is a material or a manufactured object. In some cases, it may be difficult to distinguish between articles and materials. One example given is that of a desk, which is an article, versus a piece of lumber, which is considered a material, even though both the desk and the piece of lumber might be objects manufactured from wood.

### Employee Hazard Communication Program

After the manufactured or imported chemical is distributed to others, responsibility for protection of employees from potential exposure becomes the responsibility of the employer in those firms that "use" (i.e., "package, handle, react, or transfer") the hazardous substances. A principal requirement for such employers is that they have a written hazard communication program. The safety and health manager should ensure that employees know about this program because the workers themselves may be asked about it by federal enforcement inspectors. One required component in the written program is a list of the hazardous chemicals known to be present in the workplace. For each of the hazardous chemicals listed, an SDS must be on hand and available to employees. If the substance was purchased prior to the right-to-know era and no SDS is on hand for a given substance, the employer is required to obtain or generate one. Safety and health managers can turn to current manufacturers or distributors, or perhaps write their own SDSs. Sometimes a state consultation agency, as described in Chapter 4, can be of assistance in identifying hazardous substances and in preparing the SDS.

Federal standards permit the SDS to be kept in any form, even within operating procedures. Sometimes it is more practical to address multiple hazards as a process, not as separate hazardous chemicals. In designing the right-to-know system, however, the safety and health manager should ensure that the required information is available for each hazardous chemical present among a group of materials in a single process and that the information is readily accessible to employees of each work shift.

In addition to retaining and maintaining SDSs, the employer must maintain the labels provided by the manufacturer or importer of the substance. Note, however, that labels are not required for portable, in-house containers intended for immediate use.

While labeling is provided by manufacturers, in many instances, the materials are subdivided into smaller containers for use in individual workstations. If materials are not immediately used, these containers must be appropriately labeled. OSHA does not specify a labeling convention to be used. The employer needs only to specify one and ensure it is consistently applied and understood. Some employers will use the widely accepted NFPA 704 diamond, Globally Harmonized System, and/or PPE requirements.

The final element of any hazard communication program is employee training. There is no mandated medium for training, except that it effectively conveys understanding of the internal procedure. Employees should know what hazards they are exposed to, how to read and understand the labels and SDSs, and follow appropriate protective measures.

A hazard communication program that has fulfilled the following will generally be accepted by OSHA:

- Obtained a copy of the rule
- Read and understood the requirements
- Assigned responsibility for tasks
- Prepared an inventory of chemicals
- Ensured containers are labeled
- Obtained SDS for each chemical
- Prepared written program

- Made SDS available to workers
- Conducted training of workers
- Established procedures to maintain current program
- Established procedures to evaluate effectiveness (Hazard Communication Guidelines for Compliance, 1987)

## INTERNATIONAL STANDARDS

When products are imported from other countries or produced for export, there can be problems in the labeling of hazardous chemicals. Various countries across the world may have different standards for the labeling of hazardous materials. Even the question of whether a hazard exists or the level of an existing hazard is sometimes called into question. To deal with these problems an international initiative has been created entitled GHS, Globally Harmonized System of Classification and Labeling of Chemicals. The GHS states, "Through variations in definitions of hazards, a chemical may be considered flammable in one country, but not another. Or it may be considered to cause cancer in one country, but not another. Decisions on when or how to communicate hazards on a label . . . thus vary around the world . . . " (GHS, 2008). For the reasons mentioned and others, the United States adopted the GHS in 2016.

### Record Retention

Records are of ever-increasing importance, and the safety and health manager should set up information systems that trace the identities, location of use, and time of use for hazardous substances, along with each employee exposure, for a retention period of *at least 30 years*. Employee medical records—except records of health insurance claims, which are maintained separately—must be preserved and maintained for the duration of employment *plus* 30 years. The reason for the very long retention period is to permit tracing of the cause of illnesses that may have extremely long latency periods after exposure to hazardous substances. Such a responsibility, of necessity, presupposes a sophisticated, often computerized, information system.

Sale of the business or closing the business does not relieve the employer of the record-retention responsibility. Upon sale of the business, the successor employer is required to receive and maintain the records. If the business is closed permanently, the employer may be required to transfer the records to NIOSH, depending on the requirements of specific standards pertaining to the hazardous substances in question.

## ENVIRONMENTAL PROTECTION AGENCY

It was stated in Chapter 1 that the safety and health manager often holds responsibility for compliance with Environmental Protection Agency (EPA) regulations. In this section, we examine this important additional responsibility that is often placed on the safety and health manager. The decades of the 1970s and 1980s saw more than $850

billion in expenditures by the American people to clean up the environment (Cleaning up the Environment, 1991). This is a serious investment on the part of our society, an investment that has been paid largely by industry and in turn by our society in increased costs of services and, especially, goods produced by these industries. How effectively and efficiently the company manages this investment in large part determines its overall competitiveness and vitality as a firm. Thus, an enterprising safety and health manager will see environmental protection as an opportunity to have a significant impact on the management of the company.

The dual roles of OSHA and the EPA were recognized in the enactment of the "Superfund Amendments and Reauthorization Act of 1986" (SARA) on October 17, 1986. OSHA responded with its standard 29 CFR 1910.120—hazardous waste operations and emergency response, sometimes called HAZWOPER. This OSHA standard covers hazardous substance response operations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and major corrective actions taken in cleanup operations under the Resource Conservation and Recovery Act (RCRA) of 1976.

In 2005, Jonathon Snare articulated, for OSHA leadership, the belief that there "is often a nexus between companies that have failed to live up to their responsibilities to protect their workers and those that have failed to live up to their responsibilities to protect the environment." In fact, in many companies, the same person oversees worker safety and health and environmental safety.

One part of the SARA provisions, Title III, is the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA). Title III establishes requirements for federal, state, and local governments and industry regarding emergency planning and reporting on hazardous and toxic materials.

At the outset of enforcement of the SARA law, the EPA published the initial list of 402 extremely hazardous substances. OSHA incorporated the list as an appendix to its HAZWOPER standard, and the list can be found in Appendix E of this book. Although the list is subject to revision by the EPA at any time, the list has never been altered in more than 20 years and remains unchanged as of January 1, 2009. It is essential that the safety and health manager keep this important list on hand and up to date for reference so that the firm can be in compliance if it uses any of the materials on the list. There are reporting requirements for these substances, and there are federal standards for protecting workers who may be exposed to them.

### Medical Surveillance

Medical surveillance requirements make up one of the elements of the OSHA standards for dealing with the EPA-listed hazardous substances. And wherever there is a medical surveillance program, there are medical records. Fundamental to the right-to-know concept is the employees' right of access to their personal medical records held by the company that employs them. A medical surveillance program is required for the following personnel:

1. All employees who may be exposed to health hazards at or above the established permissible exposure limits for 30 days or more a year, whether or not the employee uses a respirator for protection against the hazards

2. All employees who wear a respirator for 30 or more days a year
3. Employees designated by the employer to plug, patch, or otherwise temporarily control or stop leaks from containers that hold hazardous substances or health hazards [i.e., members of hazardous material (HAZMAT) teams]

The medical surveillance program serves both to determine whether the person is fit to work with the hazardous materials present and to recognize any adverse effects on the worker arising from the exposure. It will be seen in Chapter 12 that various conditions, such as heart problems, the wearing of a beard, or even a perforated eardrum, could disqualify the employee from working in jobs requiring the use of a respirator.

Monitoring the adverse effects of exposure is the other, and perhaps more important, purpose of the medical surveillance program and the purpose that relates most to the right-to-know principle. The worker wants to know everything the employer knows about his or her health and its possible deterioration due to hazardous exposures on the job.

Federal standards prescribe intervals at which medical examinations and consultations shall be made. The regular times are as follows:

1. Prior to assignment to duties that may require hazardous material exposure
2. At least every 12 months during assignment to such duty
3. Upon termination of such duty, unless the employee has had an examination within the last 6 months

In addition to these regular intervals, an examination is required as soon as possible if an employee develops signs or symptoms indicating possible overexposure or if an unprotected employee becomes exposed in an emergency situation. Also, the examining physician might advise that increased frequency of examination is medically necessary, and in such instances, the employer is obliged to comply. All medical examinations and procedures are required to be performed by or under the supervision of a licensed physician, at a reasonable time and place, without cost to the employee, and without loss of pay for employee time lost.

It is the business of the safety and health manager to be aware of the circumstances that require a medical surveillance program and to ensure that company management implements such a program if necessary. In presenting such a recommendation to management, the safety and health manager can point out certain legal benefits to the company over and above the benefits of increased safety and health of employees and avoidance of OSHA fines. A record of the initial medical examination can be proven to be a valuable piece of evidence of preexisting conditions or symptoms in the event such conditions or symptoms surface during worker exposure. Management may already be aware of that, but what many management personnel have overlooked is the importance of the medical examination at the end of employment also. This serves the purpose of documenting conditions, symptoms, or lack of symptoms at the end of the period of risk. In this age of right to know, employees are usually aware that they can take legal action at a later date if symptoms related to the hazardous material exposure reveal themselves after the fact. At such time, the content of the medical examination at employee termination will have obvious value to the employer as well as to the employee.

Full disclosure in the spirit of a person's right to know extends to the physician also. The employer is required to provide the examining physician with a copy of the federal standard covering medical examinations and must provide data pertaining to the employee's job, anticipated exposure levels, personal protective equipment to be used, and information from previous examinations.

It is the responsibility of the employer to obtain and furnish the employee with a copy of a written opinion from the examining physician containing the results of the examination, including any opinions or recommendations by the physician regarding increased risk or limitations on the employee's assigned work. In the interest of privacy, however, the written opinion obtained by the employer is prohibited from revealing specific findings or diagnoses unrelated to occupational exposure.

### Reporting

Title III of the SARA act requires the EPA to establish an inventory of toxic chemical emissions from certain facilities. This is in effect a reporting requirement for a number of industries with 10 or more employees by NAICS classification that have manufactured, processed, or otherwise used a *listed* toxic chemical in excess of specified threshold quantities. The term *listed* refers to one of the extremely hazardous substances listed by the EPA (see Appendix E). Threshold quantities vary and are different, depending on whether the facility uses *or* manufactures the hazardous substance. Facilities that *use* listed toxic substances in quantities over 10,000 pounds in a calendar year are required to submit toxic chemical release forms (EPA Form R) by July 1 of the following year. For firms that *manufacture* or *process* these materials, the threshold quantity is 25,000 pounds per year, for amounts above which the firm is required to submit the toxic chemical release form.

The industry classifications required to report can be found on the EPA Website and are also included in Appendix F of this text. The list primarily categorizes based on the first three digits of the NAICS; however, there are some exceptions down to the six-digit level. Therefore, it is recommended by the EPA to lookup their exact classification.[1]

For firms that both manufacture *and* use the same substance, if the threshold quantity is exceeded in either instance, then the firm must report, a point illustrated by Case Study 5.2. In Case Study 5.3, neither threshold is exceeded.

**CASE STUDY 5.2**

A fertilizer plant (NAICS Code 325311) produces 22,000 pounds of ammonia, 16,000 pounds of which it uses within the plant. Is the firm required to report to EPA, and if so, in what manner?

***Solution***

Yes, the firm has an NAICS which falls under the reporting requirements (three-digit code, 325, Chemical Manufacturing) and exceeds the "use" threshold; therefore,

[1]Appendix F identifies the principal manufacturing categories of the SIC Code.

the firm must report to EPA using the Toxic Chemical Release Inventory Reporting Form R in accordance with Title III of the SARA Act of 1986. Since one of the thresholds was exceeded (the "use" threshold), the firm must complete a full report based on all activities and releases of ammonia from its facility, not just the releases from the use activity. (This study assumes that the firm had 10 or more employees.)

**CASE STUDY 5.3**

During a year of operations, a manufacturer of chemical coatings (NAICS code 325211) processes 20,000 pounds of cresol and uses 6000 pounds of it within the plant. Is the firm required to report to EPA, and if so, in what manner?

***Solution***

No, the firm is not required to report either its processing or its use of cresol, because neither the "use" nor the "processing" thresholds were exceeded.

One other point should be made about threshold amounts. Stockpiling a material that is neither processed nor used within the plant does not count toward the computation of whether the threshold quantity has been exceeded. The EPA may ask about total stockpiled amounts in the course of collecting data for a chemical for which a threshold has been exceeded, but stockpiling does not constitute processing or use.

Firms that manufacture or process materials in excess of the threshold quantity in a year are required to submit a toxic chemical release form. The form is in four parts and is too lengthy to be included here, but it can be obtained by requesting EPA Form R from the agency's regional or national office or by contacting the designated state office (designated Section 313 contact). The form is designed to gather data for a national computer information system and includes entries disclosing basic data on the process within the plant, including maximum amounts on site; receiving stream or water body, if applicable; quantities of release into the atmosphere; off-site disposal locations; and waste-treatment methods and efficiency.

In addition to the requirement for filing the toxic chemical release form, emergency notification is required by telephone, radio, or in person if there is a release of a listed hazardous substance that exceeds the reportable quantity for that substance. This includes substances listed by EPA as extremely hazardous (see Appendix E) and substances subject to the emergency notification requirements under CERCLA. Each such notification must be followed with a written confirmation including additional information on actual response actions taken, any known or anticipated data on chronic health risks associated with the release, and advice regarding medical attention necessary for exposed individuals. The requirements for information flow between private companies and the various governmental agencies that have a role in the control of hazards arising from toxic substances result in a complex information network that is best visualized by use of a diagram (see Figure 5.6).

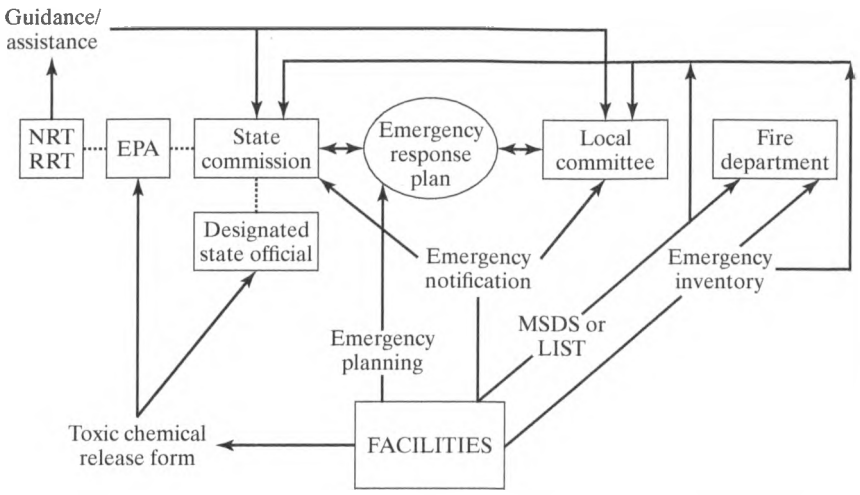



**FIGURE 5.6**

Major information flow requirements under Title III of the SARA act.

Note in Figure 5.6 that one of the parties to be notified is the "Fire Department," an emergency responder. It is necessary that emergency responders have essential information for cross reference in the event they are called upon to deal with an emergency situation in the presence of the toxic chemical release. This is necessary even for emergencies unrelated to the release, because emergency responders may need to take protective action to enter areas exposed to the toxic chemical.

## DEPARTMENT OF HOMELAND SECURITY

The terrorist attacks of September 11, 2001, dramatically changed the perspective of the nation as a whole, and of the emergency responders in particular. The U.S. Department of Homeland Security (DHS) was established on November 25, 2002, as a cabinet-level agency, a little more than 1 year after the attacks. The Environmental Protection Agency and its reporting system, described earlier in this chapter, were required by presidential directive to support the DHS whenever a nationally significant terroristic event occurs anywhere in the United States.

The Department of Homeland Security, though a newcomer, is the third largest cabinet-level department in the U.S. government, after the Department of Defense and that of Veterans Affairs. With more than 200,000 employees and the incorporation of 22 government agencies into a single organization, the creation of the DHS is considered the largest reorganization of the U.S. federal government in history (Perl, 2004). Safety and health managers should see DHS as an opportunity to make a vital contribution to the management of their own firms. Disaster planning should include the possibility of acts of terrorism. Vulnerabilities in industrial processes should be examined for increased security and emergency procedures. Chapter 6 of this book will address planning for such process emergencies.

## COMPUTER INFORMATION SYSTEMS

In the preceding section, reference was made to a national computer information system for toxic chemical data. Increasingly, safety and health managers, both within and outside government, are turning to computerized databases for quick access to detailed facts about the thousands of toxic substances and other workplace hazards. This development follows on, and sometimes coordinates with, earlier computerized management information systems for administration and reporting under the record-keeping requirements of OSHA, as described in Chapter 2.

### Artificial Intelligence and Expert Systems

One of the technologies that shows particular promise in the management of safety and health information systems is the general field of artificial intelligence, or more specifically, expert systems. Artificial intelligence is the general field of development that is attempting to make computers "think" or respond to problem-solving situations more in the manner in which humans do. Expert systems is the branch of artificial intelligence that encompasses computer systems that give advice based on a knowledge base of logic rules provided by a human expert. Thus, the computer is able to answer questions posed by a wide variety of problem situations and provide advice or assistance much as a human expert would. A key point to understand with these systems is that an exhaustive list of answers to specific questions has not been preprogrammed into the computer. Rather, the human expert has provided the basic logic or rules of thumb, and the computer is capable of gleaning what it needs to know from this knowledge base to answer specific questions in the future. Augmenting the logic of the human expert is the computer's power to rapidly pinpoint facts accessed from massive tables contained in on-line data systems. A prominent element in the advancement of expert systems is the evolution of *natural language* interfaces that empower the computer to understand requests expressed in ordinary English, instead of in the rigid formats of computerese. Such interfaces are often called *intelligent front ends*, a reference to their appending to the front of existing computerized database management systems to make these systems more user friendly and more capable of understanding human requests for answers to questions.

### Industrial Chemical Hazards Databases

The need for tiny details about characteristics of thousands of obscure substances has made industrial chemical hazards and the right to know about them an ideal application for sophisticated computer databases. The key component of such systems is a relational database with a primary table and secondary tables for cross reference.

Each chemical in the database is typically keyed to its CAS number.[2] This identifier is used to key the chemical name to a variety of synonyms that might be employed by various workers or users that might query the database via a computer terminal. The user need not know the CAS number itself; it is a cross-reference tool, internal to the database. Thus, using natural language, a user may inquire about "coal tar naphtha" and the relational database will recognize that this is a synonym for benzene and

[2]Chemical Abstracts Service number, a well-known reference list for substances.

will respond to the user's questions as if the questions were about benzene. The user can inquire about such particulars as protective eyewear required or recommended, if any, first-aid instructions, or perhaps washing instructions. If the user does not know what chemical he or she is dealing with, but has symptoms of exposure or can identify target organs affected, the relational database can use its cross-referencing capability to retrieve answers to inquiries, in addition to identifying the chemical or groups of chemicals that match the symptoms. Figure 5.7 shows typical relationships of the various files in a database available for retrieval in response to a user inquiry. Case Study 5.4 exhibits an application of a relational database using an inquiry worded in a natural language format acceptable to the system.

**CASE STUDY 5.4**

Suppose a medical examination reveals that a worker has developed symptoms of kidney damage. The plant safety and health manager becomes curious about whether any hazardous chemicals used in the plant could be associated with kidney damage and poses the following question: "Give me a list of all the chemicals that harm the kidney." The system would automatically scan all of the relevant tables in the relational database to find the desired information, merging information using the CAS number cross-reference key to provide the requested response.

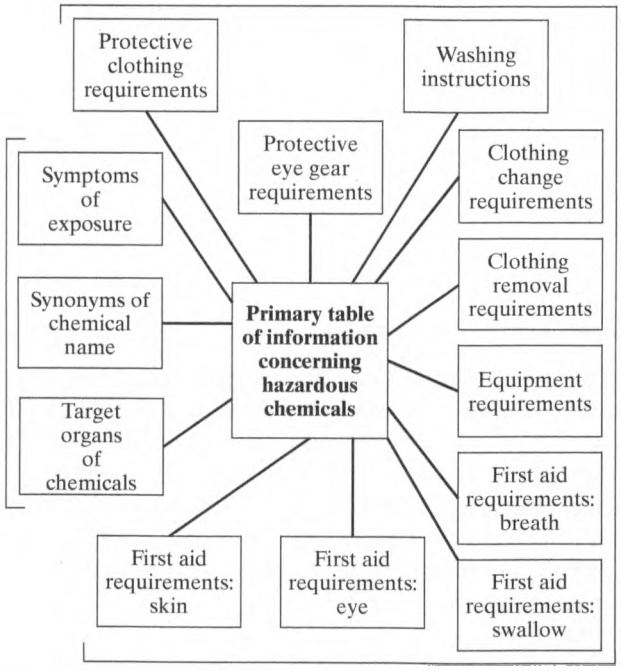



**FIGURE 5.7**

Industrial chemical hazards database design.

On the Internet, there is a wealth of data for dealing with the hazards of chemical exposures. Employers and workers alike can access these data and be "in the know" about the hazards of specific chemicals, how to protect against these hazards, what jobs entail vulnerability to exposure to these chemicals, how to recognize the symptoms of exposure, what to expect in terms of long-term health hazards, and the case histories of others who have been exposed to these chemicals. This powerful knowledge has changed the ways in which people are willing (or not willing) to work in certain jobs and has changed the way employers do business.

## SUMMARY

This chapter has afforded a glimpse of current developments in managing and making accessible the large volumes of detailed data necessary to protect workers from hazards in the workplace. The evolution is the result of two developments: advancements in information technology and increased interest on the part of workers and the public who are asserting their right to know about hazardous substances to which they are, or might become, exposed. Regulated by both EPA and OSHA, chemical hazards were the first to receive attention in the right-to-know movement. But it is projected that information system needs for safety and mechanical hazards will follow.

## EXERCISES AND STUDY QUESTIONS

**5.1** With regard to responsibility for risk in the workplace, describe the change in emphasis that occurred in the early 1980s.

**5.2** Does right to know represent a strengthening or weakening of workers' powers in the fight for improved safety and health? Explain.

**5.3** What type of container is expressly exempted from the hazard communication standards for labeling?

**5.4** For purposes of hazard communication, what is the difference between an article and a material?

**5.5** How may chemical companies protect their trade secrets despite requirements to furnish SDSs?

**5.6** Are SDSs required for mixtures in which some ingredients are hazardous and others are not? Explain.

**5.7** Is an SDS required for a chemical that was purchased by a plant before the hazard communication standard?

**5.8** How long must records be kept to trace the use of hazardous substances? Why?

**5.9** How long must employee medical records be preserved?

**5.10** What should the safety and health manager do about records if a firm decides to go out of business?

**5.11** What do the acronyms SARA, CERCLA, and RCRA represent, and how do they relate to OSHA?

**5.12** What is the function of a HAZMAT team?

**5.13** Under what circumstances is a medical surveillance program required for a given employee? How frequently are medical examinations required for such an employee?

**5.14** If an emergency notification of an accidental release of a toxic chemical is required, who should be notified?

**5.15** What are expert systems?
**5.16** What identifer is typically used by chemical databases to act as a cross-referencing tool to key to properties of the chemical?
**5.17** What does the term HAZWOPER represent?
**5.18** How many billions of dollars are estimated to have been spent by Americans to clean up the environment in the 1970s and 1980s?
**5.19** How does right to know shift responsibility for safety and health?
**5.20** How does right to know impair employer immunity to litigation for workplace hazards?
**5.21** What legal benefits of a medical surveillance program go beyond the benefits of increased safety and health of employees?
**5.22** What responsibility to the examining medical physician is placed upon the employer by federal standards?
**5.23** What information from medical examinations is required to be communicated in writing to employees? What information is protected and must not be revealed to the employer in the physician's written opinion?
**5.24** What are the top three largest cabinet-level federal agencies? Which of the three is a newcomer to the government in the twenty-first century?
**5.25** What is the system known as "GHS?" How many countries worldwide had adopted this system by the year 2016?
**5.26** The familiar term MSDS has been replaced by a new term with the adoption of the new GHS. What is the name of this new term and what does the name represent?
**5.27** With what professional society did OSHA team up with to create tables for health and physical hazard classification from the hazard communication standard 1910.1200?
**5.28** Compare the meanings of the terms "articles" and "materials" as seen by GHS.
**5.29** What is the major difference between the GHS Safety Data Sheet and the previous MSDS in determining the hazards?
**5.30** What are the two major classes of hazards in the GHS?
**5.31** Why are pictograms mandated in GHS?
**5.32** Why are alcoholic beverages excluded from OSHA's requirement for container labeling?
**5.33** Does OSHA control tobacco use in the workplace?
**5.34** An employee is packaging a hazardous chemical, Is the manufacturer of the chemical or the worker's employer responsible for the worker's safety?

## RESEARCH EXERCISES

**5.35** Use your favorite search engine on the Internet to find how many Internet sites are related to the term "HAZWOPER."
**5.36** Determine the criteria for how much HAZWOPER training is required for various employees. (*Hint*: What determines whether an employee needs 8, 24, or 40 hours of training?)
**5.37** Find the names of five firms or institutions that offer 40-hour courses in HAZWOPER training for client companies.
**5.38** Check the Internet to find an SDS for hydrazine sulfate.

## STANDARDS RESEARCH QUESTIONS

**5.39** Search the OSHA general industry standards for the term *hazard communication*. Use the OSHA website to research the annual number of citations related to "hazard communication." What percentage of these citations is "serious"?

**5.40** Determine which general industry OSHA standards relate to the term *SDS*. How many citations are found on the Companion Website's database that pertain to "SDS"?

**5.41** Determine whether any OSHA general industry standards are being cited for "medical surveillance" violations.