1. OVERVIEW OF HOSPITAL HAZARDS

1.1 OCCUPATIONAL INJURY AND ILLNESS AMONG HOSPITAL WORKERS

Hospitals employ approximately 4.5 million of the 8 million health care workers in the United States, or about 4% of the total U.S. workforce (BLS 1988). The percentage distribution of hospital workers by occupation is shown in Appendix 1.

Few workplaces are as complex as the hospital. Not only does it provide the basic health care needs for a large number of people, but it is often a teaching and research center as well. As a result, the list of potential hazards includes radiation, toxic chemicals, biological hazards, heat, noise, dusts, and stress.

Maintenance workers are potentially exposed to solvents, asbestos, and electrical hazards. Persons working in or around boiler rooms are regularly exposed to high levels of noise and heat.

Housekeepers are exposed to detergents and disinfectants that can cause skin rashes and eye and throat irritation. They risk exposure to hepatitis and other diseases from hypodermic needles that have not been discarded properly. Sprains and strains are also common problems for housekeepers.

Food service workers face problems such as cuts from sharp-edged equipment, burns from hot surfaces and steam lines, falls on slippery floors, and fatigue and stress from long periods of standing on hard surfaces. Nonionizing radiation from improperly maintained microwave ovens is a potential hazard. Skin rashes from fresh foods, detergents, and humidity are also common, and excessive exposure to noise has been documented.

Registered nurses (RN's), nurse practitioners, and licensed vocational/licensed practical nurses (LVN's/LPN's) confront such potential problems as exposure to infectious diseases and toxic substances, back injuries, and radiation exposure. Nurses also deal with less obvious hazards resulting from stress and shift work.

Radiology technicians are potentially exposed to radiation from X-rays and radioactive isotopes. Even with the adequate maintenance of equipment, risks can result from incorrect work practices (such as holding infants under a radiation beam without adequate self-protection) or from infectious diseases transmitted by patients. Radiology technicians may also be exposed to chemical hazards.

Operating-room workers (both female and male, and the wives of male workers) may face the increased risk of reproductive problems as a result of exposure to waste anesthetic gases. They are also subject to cuts and puncture wounds, infection, radiation, and electrical hazards.

1.1.1 Published Data

A 1972 national survey of occupational health services in more than 2,600 hospitals reported an annual average of 68 injuries and 6 illnesses among workers in each institution (NIOSH 1974-1976). The most frequent injuries were strains and sprains, followed by puncture wounds, abrasions and contusions, lacerations, back injuries, burns, and fractures. The most frequent illnesses were respiratory problems, infections, dermatitis, hepatitis, and drug or medication reactions. Although studies have shown the adverse effects of some hospital hazards such as anesthetic gases, ethylene oxide, and certain cytotoxic drugs, the effects of many others are not well understood. Hazard surveillance data in the hospital industry (NIOSH 1985) have identified 159 known primary skin or eye irritants used in hospitals and 135 chemicals that are potentially carcinogenic, teratogenic, mutagenic, or a combination of these (see Appendix 4).

In 1978, the California State Department of Industrial Relations published injury and illness data for 1976-1977 from an intensive study of hospital personnel (California Department of Industrial Relations, 1978). The work injury rate in convalescent hospitals (8.4 lost workday cases per 100 full-time workers) was almost double that in acute-care hospitals and in all California industries. Major causes of disabling injury and illness were strain or overexertion, falls or slips, being struck by or striking against objects, burns, and exposure to toxic or noxious substances. Workers with the highest reported number of injuries and illnesses were aides, nursing attendants, orderlies, kitchen workers, housekeeping and maintenance workers, laundry room workers, RN's, LVN's/LPN's, clerks and office workers, and technicians. In Florida, the annual rate of illness and injury reported for hospital workers was 10.0 per 100 workers--about the same as that recorded for sheet metal workers, auto mechanics, and paper mill workers (American Journal of Nursing 1982).

Two national data systems have been analyzed by Gun (1983): (1) the National Health Interview Survey (1970-1977), which describes the hospital workforce and compares the rates of acute and chronic conditions for hospital workers with those for the total workforce, and (2) compensation data from the Bureau of Labor Statistics. The study compared disease rates for hospital workers with data for all workers combined from the National Health Interview Survey.

1.1.2 Chronic Conditions

Gun (1983) noted that an excessive incidence of some chronic conditions among hospital workers was clearly due to primarily female medical conditions in a predominantly female workforce. After allowance was made for this factor, six conditions of interest were found:

1. Hypertension, among service and blue collar workers
2. Varicose veins, among nearly all categories of hospital workers
3. Anemia, mostly among females, but sex bias was not the sole cause of excess incidence
4. Diseases of the kidneys and urinary system, mostly among females (69%), but an excess incidence appeared in all categories of hospital workers
5. Eczema, dermatitis, and urticaria, mostly among females (57%), but an excess incidence appeared in most categories of hospital workers
6. Displacement of intervertebral disc (low-back injury), mostly among females (166% relative risk)

No data were provided on the risks of diseases such as cancer or reproductive impairment.

1.1.3 Acute Conditions

Hospital workers had a significantly greater incidence of acute conditions compared with all workers in all categories of sex, race, age, and occupational status (Gun 1983). Respiratory problems accounted for more than half of all acute conditions in both hospital workers and all workers. The incidence of every major category of acute condition was higher in hospital workers than in all workers. The risk for hospital workers was about 1.5 times greater than that for all workers, and it was statistically significant for all conditions, including infectious and parasitic diseases, respiratory conditions, digestive system conditions, and "other" conditions (diseases of the ear, headaches, genitourinary disorders, problems associated with childbirth, disorders of pregnancy and the puerperium, and diseases of the skin and musculoskeletal system). The risk of injury for hospital workers was only slightly greater than for all workers.

1.1.4 Compensable Injury and Disease

A review of data from the Bureau of Labor Statistics (BLS 1983) for compensable injury and disease showed that sprains and strains (often

representing low-back injury) were by far the most common type of condition, constituting 51.6% of the total (Table 1-1). The data in Table 1-1 also show that cuts, lacerations, and punctures account for a significant number of hospital workers' compensation claims. Because these injuries also have a potential for contamination with blood and other body fluids, they should be carefully monitored and recorded. Employers should provide medical consultation for workers who sustain puncture wounds involving potentially infectious materials.

The injuries and illnesses listed in Table 1-2 are reported more commonly on hospital workers' compensation claims compared with those of all civilian workers. An excess percentage of hospital workers' compensation claims resulted from the following conditions: strains and sprains, dermatitis, serum and infectious hepatitis, mental disorders, ill-defined conditions, eye diseases, influenza, complications peculiar to medical care, and toxic hepatitis.

1.2 GROWTH OF OCCUPATIONAL SAFETY AND HEALTH PROGRAMS FOR HOSPITAL WORKERS

Until recently, safety and health policies in hospitals were developed mainly for patients, not workers. Traditionally, hospital administrators and workers considered hospitals and health institutions safer than other work environments and recognized mainly infectious diseases and physical injuries as risks in the hospital environment. Administrators have therefore emphasized patient care and have allocated few resources for occupational health. The following factors have contributed to the lack of emphasis on worker health:

- Hospital workers have been viewed as health professionals capable of maintaining their health without assistance.
- The availability of informal consultations with hospital physicians reduces the use of worker health services.
- Hospitals are oriented toward treating disease rather than maintaining health.

1.2.1 Early Attempts to Protect Workers

Although infectious diseases, like most hospital hazards, were first recognized as risks for patients rather than staff, early attempts to protect patients against hospital infections also benefited workers. For example, Florence Nightingale introduced basic sanitation measures such as open-window ventilation and fewer patients per bed; and the Austrian surgeon, Semmelweis, initiated routine hand-washing more than a century ago. New hazards began to appear in the 1900's when physicians experimenting with X-rays were exposed to radiation, and operating-room

Table 1-1.--Workers' compensation claims for injury or illness among hospital workers (SIC 806)*

Condition	Claims	
	Number†	% of total
Sprains, strains	35,405	51.6
Contusion, crushing, and bruising	7,635	11.1
Cuts, lacerations, and punctures	7,374	10.8
Fractures	3,865	5.6
Multiple injuries	1,473	2.1
Thermal burns	1,343	2.0
Scratches, abrasions	1,275	1.9
Infectious and parasitic diseases	865	1.3
Dermatitis and other skin conditions	850	1.2
All other	8,484	12.4
Total	68,569	100.0

*Adapted from information published in the Supplementary Data System by the U.S. Department of Labor, Bureau of Labor Statistics (1983).
†Figures are adjusted to allow for States that do not provide a sample of their cases.

Table 1-2.--Conditions reported more commonly on hospital workers' (SIC 806)* compensation claims

Condition	Hospital workers		All civilian workers	
	Number†	%	Number†	%
Sprains, strains	35,405	51.63	649,685	37.76
Infectious and parasitic diseases:				
Unspecified	35	.05	142	.01
Conjunctivitis	102	.15	366	.02
Tuberculosis	87	.13	183	.01
Other	641	.93	2,063	.12
Total	865	1.26	2,754	.16
Dermatitis:				
Unspecified	68	.10	1,291	.08
Contact dermatitis	407	.59	9,180	.53
Allergic dermatitis	106	.15	2,042	.12
Skin infections	223	.33	812	.05
Other	22	.03	402	.02
Skin conditions not elsewhere classified	24	.04	191	.01
Total	850	1.24	13,918	.81
Serum and infectious hepatitis	362	.53	903	.05
Mental disorders	360	.53	5,775	.34
Ill-defined conditions	263	.38	4,880	.28
Eye diseases	250	.36	4,805	.28
Influenza	136	.20	2,389	.14
Complications peculiar to medical care	114	.17	295	.02
Toxic hepatitis	37	.05	95	.01
Total	38,642	56.35	685,499	39.85

*Adapted from information published in the Supplementary Data System by the U.S. Department of Labor, Bureau of Labor Statistics (1983).
†Figures are adjusted to allow for States that do not provide a sample of their cases.

personnel faced possible explosions during surgery involving anesthetic gases. These hazards finally called attention to the many dangers facing hospital workers, and hospitals began to monitor their workers for tuberculosis and other infectious diseases.

1.2.2 Development of Worker Health Programs

In 1958, the American Medical Association (AMA) and the American Hospital Association (AHA) issued a joint statement in support of worker health programs in hospitals. In addition to describing the basic elements of an occupational health program for hospital workers, they stated that "hospitals should serve as examples to the public at large with respect to health education, preventive medicine, and job safety" (AMA 1958). NIOSH subsequently developed criteria for effective hospital occupational health programs (NIOSH 1974-1976) (see Appendix 2).

1.2.3 The NIOSH Hospital Survey

NIOSH undertook the first comprehensive survey of health programs and services for hospital workers in 1972 (NIOSH 1974-1976). Questionnaires sent to hospitals of all sizes throughout the country were completed at more than 2,600 hospitals. The results demonstrated important deficiencies in the worker health programs of most hospitals, especially hospitals with fewer than 100 beds.

Although 83% of the hospitals surveyed gave new workers at least a general orientation on safety and health, only about half of the hospitals had a regular safety and health education program. Only 35% of the small hospitals had regular safety and health education programs, whereas 70% of the large hospitals had them.

Other inadequacies uncovered by the survey included a lack of immunization programs for infectious disease control (only 39% of surveyed hospitals had such programs) and an absence of in-service training in critical areas (only 18% of surveyed hospitals provided training in six critical areas identified).

Since the NIOSH survey, the number and size of worker health programs in hospitals and health facilities have increased rapidly across the Nation. The number of trained professionals is still limited, however, and although some hospitals have expanded the roles of infection-control committees, others have assigned control duties to security or other administrative personnel who have little training or experience in occupational safety and health.

1.3 WORKER HEALTH PROGRAMS AND SAFETY AND HEALTH COMMITTEES

Only 8% of the hospitals reporting in the 1972 NIOSH survey (NIOSH 1974-1976) met all nine NIOSH criteria for comprehensive hospital safety and health programs (Appendix 2). Many hospitals have since taken steps to initiate or improve worker health services: (1) Professional organizations have been formed for hospital safety officers and worker health service personnel; (2) the number of articles, books, and other published resources on hospital safety and health have increased dramatically; and (3) several organizations now offer annual conferences on occupational health for hospital workers.

In 1977, NIOSH published a full set of guidelines for evaluating occupational safety and health programs in hospitals (NIOSH 1977). Appendix 2 contains these guidelines. See also Kenyon (1979) for the practical design of a full safety and health program.

Some hospitals have established joint labor-management safety and health committees. Labor unions representing workers in other hospitals have formed safety and health committees that have made important contributions by identifying safety and health problems and by educating the workforce about safety and health issues.

Major functions of safety and health committees include the following:

- Inspecting workplaces regularly to identify safety and health hazards
- Regularly reviewing accident rates, results from prevention activities, and other relevant workplace data
- Preparing information for workers on identified hazards
- Organizing educational classes
- Reviewing safety and health aspects when planning new construction or renovating facilities
- Investigating accidents
- Establishing motivational programs (e.g., recognition, awards, and dinners) to stimulate worker participation in safety and health activities

Strong and effective safety and health committees require the full support and commitment of the hospital administration. Committee functions should not be informal tasks for the members but a regular part of their job responsibilities.

The safety and health committees of labor unions have played important roles in articulating worker concerns, identifying potential hazards, educating their members, and improving work practices. For example, a union safety and health committee in New York City that was investigating risks associated with handling infectious disease specimens (Stellman et al. 1978) identified clusters of hepatitis cases among personnel in the chemistry laboratory, the intensive care unit, and the blood-gases laboratory. After meeting with hospital representatives and studying the problem, the committee identified several potential problem areas. Specific actions were initiated to correct unsafe work practices and conditions. Such safety and health committees can help ensure safe work environments in hospitals.

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2. DEVELOPING HOSPITAL SAFETY AND HEALTH PROGRAMS

2.1 ADDRESSING DIVERSE NEEDS

The diverse safety and health concerns in hospitals are traditionally divided into hazards that pose an immediate threat and hazards that cause long-term health problems. Safety hazards include sharp-edged equipment, electrical current, and floor surfaces that can contribute to slipping or tripping. Health hazards are often more difficult to identify than safety hazards. They may result in an immediate illness or in the long-term development of disease. Although a needle puncture may result in hepatitis in 90 to 180 days, exposure to excess radiation or to some chemicals may not result in any noticeable health effects for 20 to 30 years. Thus workers may appear and feel healthy when, in fact, their health is being seriously threatened. Because workers are often exposed to hazards for which the effects are not well known, they may have difficulty associating a new illness with past workplace exposures.

This section contains steps for developing safety and health programs to identify and control occupational hazards within the hospital setting. These steps are summarized in Table 2-1. Personnel trained in occupational safety and health are needed to design, implement, and manage such a program. Many organizations listed in this manual offer courses designed specifically to train nurses, safety officers, physicians, and nonprofessional workers (see Section 7).

2.1.1 Enlisting Administrative Support

Developing an appropriate and useful safety and health program for a hospital or health facility requires the involvement of a safety and health committee that represents workers and supervisors from all departments in the hospital. Such involvement is essential because workers frequently observe real and potential hazards that supervisory staff, the employee health service, or other safety and health personnel do not recognize. To be effective, committee members should be knowledgeable in occupational safety and health and have explicit responsibilities and appropriate authorities.

Table 2-1.--Checklist for developing a hospital safety and health program

Item	Component tasks
1. Administrative support	Form a safety and health committee.
	Appoint a safety officer, employee health director, and other responsible personnel.
	Allocate time for surveys and committee meetings.
	Allocate funds to evaluate and monitor hazards, implement controls, and conduct health examinations.
2. Hazard identification	Conduct periodic walk-through inspections.
	Obtain material safety data sheets (MSDS's) and other information on potential hazards.
	Maintain a log of hazardous chemicals and materials that are used or stored in each department.
3. Hazard evaluation	Conduct safety inspections and industrial hygiene monitoring of potential hazards and determine needs for hazard controls.
	Conduct medical evaluations.
	Select appropriate medical surveillance programs.
4. Training	Develop and begin a training program for workers, based on job responsibilities.
5. Controls	Select appropriate control measures and implement controls and medical surveillance programs as determined in Item 3.

(continued)

Table 2-1 (Continued).—Checklist for developing a hospital safety and health program

Item	Component tasks
6. Program review	Preview results of periodic safety inspections, industrial hygiene monitoring, and medical surveillance programs to find patterns of hazards, to measure the success of the safety and health program, and to determine the effectiveness of controls. Change the safety and health program as new materials or procedures are introduced or as new hazards are identified in the review process.
7. Recordkeeping	Maintain records of results for all surveys, evaluations, monitoring, corrective actions, and worker medical examinations. Records must be maintained in accordance with applicable local, State, and Federal regulations.

2.1.2 Identifying Hazards

Hazard identification involves not only recognizing the hazards themselves but also learning their specific characteristics and identifying the population at risk so that control programs can be designed. See also sections 5 and 7 of this document for further details on obtaining necessary hazard information.

2.1.2.1 Walk-Through Inspections

Hospital safety and health personnel should conduct an initial survey of safety hazards such as those outlined in Section 3. The hospital safety and health committee should assist with this in consultation with workers from each department. The first step in identifying hazards is usually a physical inspection called a walk-through survey. Persons conducting the survey actually walk through the unit and note as many hazards as possible.

During a walk-through survey, survey personnel should communicate with supervisors and workers in each department, follow a checklist, and ask any additional questions that may arise. For example, have common health problems been noticed among the workers in the department? Do any hazards

exist that are not on the checklist? How is the department different from a typical department of its type? A diagram of each department should be developed to include the number and location of workers and the sources of potential exposure. Several organizations listed in Section 7 have developed sample checklists for walk-through inspections.

2.1.2.2 Published Sources of Information

The following references should be consulted when considering the potential toxicity of substances used in the hospital:

1. Occupational Diseases: A Guide to Their Recognition (NIOSH 1977)
2. NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards (NIOSH 1978a)
3. NIOSH Pocket Guide to Chemical Hazards (NIOSH 1985)
4. Chemical Hazards of the Workplace (Proctor and Hughes 1978)

2.1.2.3 Material Safety Data Sheets

In 1975, NIOSH developed a basic format for material safety data sheets (MSDS's) to provide information on the content, potential toxicity, recommended handling methods, and special precautions for substances found in the workplace (NIOSH 1974). In 1986, OSHA promulgated a hazard communication standard requiring that the following information be included on MSDS's (29 CFR* 1910.1200):

- Product identity from the label, including chemical and common names of hazardous ingredients
- Physical and chemical characteristics of ingredients (e.g., vapor pressure and flash point)
- Physical hazards of ingredients (potential for fire, explosion, and reactivity)
- Health hazards associated with ingredients (including signs and symptoms of exposure and any medical conditions generally recognized as being aggravated by exposure to the product)
- Primary routes of entry to the body

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*Code of Federal Regulations. See CFR in references.

- The OSHA permissible exposure limit (PEL), the ACGIH threshold limit value (TLV®), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the MSDS

- An indication as to whether the product and/or ingredients are listed in the National Toxicology Program (NTP) Annual Report on Carcinogens (latest edition) or are designated as a potential carcinogen by OSHA or in the International Agency for Research on Cancer (IARC) Monographs (latest editions)

- Any generally applicable precautions for safe handling and use known to persons preparing the MSDS (e.g., appropriate hygienic practices, protective measures during repair and maintenance of contaminated equipment, and procedures for cleanup of spills and leaks)

- Any known, generally applicable control measures (e.g., appropriate engineering controls, work practices, or personal protective equipment)

- Emergency and first aid procedures

- Date of MSDS preparation or last amendment

- Name, address, and telephone number of a responsible party who can provide additional information on the hazardous chemical and on appropriate emergency procedures

NIOSH also recommends that MSDS's contain the NIOSH recommended exposure limit (REL). MSDS's must also be updated with any new data on the hazards of a chemical or new methods for protecting workers from the hazards. For further information regarding the identification of hazardous materials, see the OSHA hazard communication standard (29 CFR 1910.1200) and the NIOSH (1974) publication entitled Criteria for a Recommended Standard: An Identification System for Occupationally Hazardous Materials.

Manufacturers are now required by Federal law to provide MSDS's with their products (29 CFR 1910.1200). The regulation requires that a specific chemical identity be made available to health professionals, workers, and their designated representatives in accordance with the provisions given in the occupational safety and health standard. This regulation also requires employers to develop a written hazard communication program and provide workers with training and information. NIOSH also recommends that hospitals provide completed MSDS's or their equivalent to personnel in materials management and purchasing or central supply before products are purchased or reordered. The hospital safety and health committee should also maintain a

file of MSDS's. Most MSDS's now available do not include information on the chronic health effects of low-level exposure, but they do provide information on the acute effects of relatively high levels.

2.1.2.4 NIOSH Policy Documents

NIOSH has prepared criteria documents and other recommendations on many hazardous substances. These extensive evaluations of the scientific literature include recommendations to the U.S. Department of Labor for controlling exposures. NIOSH documents are available for the following substances and agents that may be found in hospitals:

- Asbestos
- Ammonia
- Benzene
- Benzidine
- Carbon tetrachloride
- Chloroform
- Chromium(VI)
- Dioxane
- Ethylene dichloride
- Ethylene oxide
- Formaldehyde
- Hot environments
- Isopropyl alcohol
- Noise
- Phenol
- Toluene
- Ultraviolet radiation
- Waste anesthetic gases and vapors
- Xylene

2.1.2.5 Occupational Health Organizations

A list of occupational health organizations appears in Section 7 of this document (Directory of Occupational Safety and Health Information for Hospitals).

2.2 EVALUATING HAZARDS

Once hazards have been identified, they should be evaluated to determine how serious the problems are and what changes can be introduced to control them (see Section 2.3). Methods for measuring exposures to hazards in the workplace are recommended in the NIOSH Manual of Analytical Methods (NIOSH 1984). Health hazards posed by chemicals (in the form of dusts, liquids, or gases), radiation, noise, and heat should be evaluated initially by an industrial hygienist. If no industrial hygienist is available, consultation can be obtained from NIOSH, OSHA, private consultants, or in some cases insurance companies.

After controls are installed, they should be checked periodically to see that they are being maintained and are protecting the workers adequately. A chart or grid should be prepared to list hazardous materials and the departments where they are usually found, exposure limits, precautions to follow, and other relevant factors. Such a chart can be a quick ref rence and a means of tracking program development.

A hazard evaluation program should consist of the following elements: periodic inspection and monitoring of potential safety and health problems, informal interviewing of workers, medical evaluations, and evaluation of worker exposures and the workplace. The following subsections contain descriptions of each element and definitions of terms commonly used in industrial hygiene standards.

2.2.1 Periodic Inspection and Monitoring of Safety and Industrial Hygiene

When an evaluation reveals a potential hazard and control measures are applied, the hazard should be re-evaluated to determine the effectiveness of the controls. Complex work procedures (e.g., operating-room practices) should be analyzed carefully, noting products and byproducts formed during the procedure.

The frequency with which hazards should be monitored depends, among other things, on the extent of exposure to the agent, the severity of the adverse effects, the complexity of the work process, seasonal variations of temperature and humidity, and protective measures. OSHA regulations mandate inspection schedules for a few substances such as asbestos (29 CFR 1910.1001). Experience and a high degree of awareness will allow each hospital safety and health committee to decide on an appropriate inspection schedule for each department.

2.2.2 Informal Interviews of Workers

In the first assessment of hazards in each work unit, a short questionnaire or informal interview with the workers may identify problems that are not easily noted by visual inspection. For example, questionnaires, informal discussions, or physical inspections may reveal a potential for back strain resulting from poor work practices, stress caused by staffing- or shift-rotation systems, or inadequate training for handling infectious materials. The following general questions should be posed:

- Since starting the job, has the worker developed any new health problems or have existing problems worsened? What symptoms have been observed? When did the symptoms begin or become more severe? When did the problems improve or become less noticeable?

- Has the worker noticed any health problems in the other workers in the same department that may be related to or caused by their work?

- Is there anything in the job that might affect the worker's health or the safety and health of other workers now or in the future?

The last question will also help identify worker concerns about the future safety and health effects of their current exposures. Remember, however, that workers may not notice a connection between symptoms and causative agents. Thus a negative response to the above questions does not necessarily mean that no safety or health problems exist. A positive response may also indicate a safety or health problem resulting from nonwork activities.

2.2.3 Medical Evaluations

The signs and symptoms that workers experience should be evaluated medically, taking care to avoid preconceptions about which ones are work related. The potential health effects of each exposure should be determined using the references mentioned earlier in this section (Subsection 2.1.2.2). An occupational history should also be maintained for each worker to help evaluate the long-term effects of exposures. This history should contain at least the worker's prior occupations and job titles, the duration of employment at each job, and the name of any substance or agent to which the worker may have been exposed.

2.2.4 Environmental Evaluations

An industrial hygienist may take area samples, personal samples, or wipe samples to help determine the extent of a workplace hazard. Most methods for chemical sampling require laboratory analysis, which should be performed by a laboratory accredited by the American Industrial Hygiene Association. The safety officer should consider using direct-reading instruments that are available. These are discussed in Air Sampling Instruments for Evaluation of Atmospheric Contaminants (ACGIH 1983).

2.2.4.1 Area Samples

Area samples from the general work space can measure the extent of potential worker exposure to chemicals, extreme temperatures, excessive noise, ionizing and nonionizing radiation, and other environmental stressors. Industrial hygienists may monitor work environments with equipment that provides information immediately, or they may use methods that require laboratory analysis of collected samples. Direct-reading sampling devices include colorimetric detector tubes, mercury "sniffers," infrared spectrophotometers, microwave survey meters, and sound-level meters. Air samples for such substances as nitrous oxide, formaldehyde, ethylene oxide, and asbestos may require laboratory analysis. Sometimes both types of sampling devices exist for the same chemical, and the choice depends on the precision and accuracy required.

2.2.4.2 Personal Samples

Personal samples are used to measure contaminants in the worker's breathing zone. Evaluations of personal exposure to chemical dusts, fumes, gases, and vapors are frequently expressed as an 8-hr time-weighted average (TWA) concentration (which is the average exposure concentration during an 8-hr workday) or as a short-term exposure concentration. The two main types of personal sampling devices are:

1. A pump mounted on the worker's belt that provides suction and draws air from the worker's lapel (breathing zone) through a tube and into the collection medium attached to the pump, and

2. A passive dosimeter (often like a large button), which can be clipped to the worker's lapel and absorbs substances from the surrounding air.

2.2.4.3 Wipe Samples

Wipe samples are analyzed to measure the contamination of work surfaces.

2.2.5 Occupational Safety and Health Standards

Worker safety and health is the responsibility of the Occupational Safety and Health Administration (OSHA), which was established in the U.S. Department of Labor by the Occupational Safety and Health Act of 1970 (Public Law 91-596). The principal function of OSHA is to promulgate and enforce workplace safety and health standards, which are contained in Volume 29 of the Code of Federal Regulations. The Occupational Safety and Health Act also created the National Institute for Occupational Safety and Health (NIOSH). The principal functions of NIOSH are to conduct research and to recommend new and improved safety and health standards to OSHA. Throughout this document, reference is made to OSHA standards and NIOSH recommendations. OSHA standards for exposure to airborne chemicals are generally referred to as permissible exposure limits (PEL's). NIOSH recommendations for controlling airborne contaminants are referred to as recommended exposure limits (REL's). The OSHA PEL's are legally enforceable standards that must also be economically feasible, whereas the NIOSH REL's are recommended standards based solely on public health considerations.

The American Conference of Governmental Industrial Hygienists (ACGIH) is a professional association that recommends limits for airborne contaminants, called threshold limit values (TLVs®). TLVs are intended to serve only as guidelines for the professional industrial hygienist; they are not intended to be enforceable exposure limits.

2.2.5.1 Terms Used in Industrial Hygiene Standards

The following terms are used in Federal standards or recommendations for the workplace.

PEL	Permissible exposure limit. A PEL is the maximum airborne concentration of a substance regulated by OSHA to which a worker may be exposed. These values are enforced by law.
ppm	Parts per million.
REL	Recommended exposure limit. A NIOSH REL is the maximum recommended exposure to a chemical or physical agent in the workplace. The REL is intended to prevent adverse health effects for all occupationally exposed workers.
TLV®	Threshold limit value. A TLV is the airborne concentration of a substance to which nearly all workers can be exposed repeatedly day after day without adverse effect (ACGIH 1987). ACGIH recommends and publishes these values annually on the basis of the most current scientific interpretations. TLVs are not OSHA standards and are not enforced by law.
TLV-C	Threshold limit value--ceiling. The TLV-C is the airborne concentration of a substance that should not be exceeded--even for an instant--during any part of the working exposure (ACGIH 1987).
TLV-SKIN	Threshold limit value--skin adsorption. TLV-SKIN refers to the potential contribution of absorption through the skin--including mucous membranes and eyes--to a worker's overall exposure by either airborne or direct contact with a substance (ACGIH 1987).
TLV-STEL	Threshold limit value--short-term exposure limit. The TLV-STEL is the maximum exposure concentration allowed for up to 15 min during a maximum of four periods each workday. Each exposure period should be at least 60 min after the last period (ACGIH 1987).

TWA — Time-weighted average. The TWA is the average exposure concentration during an 8-hr workday. Exposure for more than 8 hr per day or more than 40 hr per week, even at or below the TLV or PEL, may represent a health hazard. NIOSH recommendations typically include 10-hr TWA's for up to a 40-hr workweek. The TWA for an 8-hr workday is calculated as follows:

$$\frac{\text{sum of [(exposure period) x (exposure concentration)] for each exposure period}}{\text{8-hr workday}}$$

For example, formaldehyde exposure in a laboratory might be:

$$\frac{(5 \text{ ppm} \times 2 \text{ hr}) + (1 \text{ ppm} \times 6 \text{ hr})}{\text{8-hr workday}}$$

$$\frac{10 + 6}{8} = 2.0 \text{ ppm TWA}$$

2.3 CONTROLLING HAZARDS

Once potential exposures and safety problems in the hospital have been identified and evaluated, priorities should be established for controlling the hazards. Identified safety hazards should be promptly corrected, and educational programs should be developed on subjects such as correct lifting procedures and the handling of electrical equipment. Workers who are potentially exposed should be fully informed and trained to avoid hazards, and controls should be instituted to prevent exposures. Control methods that can be used for environmental hazards include substitution, engineering controls, work practices, personal protective equipment, administrative controls, and medical surveillance programs. Each of these methods is discussed in the following subsections.

2.3.1 Warning Systems

Any system designed to warn workers of a hazard should

- Provide immediate warnings of potential danger to prevent injury, illness, or death
- Describe the known acute (short-term) or chronic (long-term) health effects of physical, chemical, and biologic agents
- Describe any safety hazards that might be encountered, including chemical exposures that might result in traumatic injuries
- Indicate actions for preventing or reducing exposure to hazards

- Provide instructions for minimizing injury or illness in the event exposure has already occurred
- Include a plan for dealing with emergency situations
- Identify the population at risk so that information is provided to the correct group of workers
- Identify actions to be taken in the case of illness or injury

2.3.2 Substitution

The best way to prevent occupational safety and health problems is to replace the offending agent or hazard with something that is less hazardous. For example, highly explosive anesthetic gases have been replaced by nonflammable gases. Replacements for asbestos are being used in new construction, and cleaning agents are often changed when workers complain of dermatitis.

2.3.3 Engineering Controls

Engineering controls may involve modifying the workplace or equipment to reduce or eliminate worker exposures. Such modifications include both general and local exhaust ventilation, isolating patients or work processes from the hazard, enclosing equipment or work processes (as in glove-box cabinets), and altering equipment (such as adding acoustic padding to reduce noise levels).

2.3.4 Work Practices

How workers carry out their tasks may create hazards for themselves and others. For example, staff, nurses, or doctors who do not dispose of used needles safely create a severe hazard for housekeepers, laundry workers, and themselves. Workers sometimes perform tasks in ways that create unnecessary exposures. This includes staff members who try to lift patients without assistance and laboratory workers who pipette by mouth rather than by rubber bulb, thereby increasing their risk of injury or contamination.

2.3.5 Personal Protective Equipment

Personal protective equipment includes gloves, goggles, aprons, respirators (not surgical masks), ear plugs, muffs, and boots. Although the use of such equipment is generally the least desirable way to control workplace hazards because it places the burden of protection on the worker, the equipment

should be available for situations when an unexpected exposure to chemical substances, physical agents, or biologic materials could have serious consequences.

Personal protective equipment is frequently uncomfortable and difficult to work in, and it must be adequately maintained. Maintenance requires constant supervision and training. The use of respirators also requires frequent testing to ensure adequate fit for each wearer. For this reason, the policy of OSHA and NIOSH has been to use personal protective equipment for preventing inadvertent exposures that are threatening to health or life only when (1) engineering and administrative controls are not feasible, (2) such controls are being developed or installed, (3) emergencies occur, or (4) equipment breaks down.

The proper selection of chemical protective clothing (CPC) requires an evaluation by a trained professional such as an industrial hygienist. The selection process must include

- Assessing the job or task
- Determining the body parts that need to be protected
- Determining the necessary flexibility and durability that will allow the worker to perform the job or task
- Assessing the exposure situation in view of the chemicals present, the toxicity of those chemicals, and the concentrations to which workers will be exposed
- Assessing existing laboratory data on the capacity of CPC to withstand contact with the chemicals during use and to prevent penetration by those chemicals (permeation data are available for many chemicals and CPC materials [ACGIH 1985] and should be consulted)
- Evaluating candidate materials in the laboratory and, if possible, at the worksite

Standard operating procedures for the proper use of CPC should be established and should include

- Training in proper ways to put on and take off CPC
- Training in proper disposal methods
- Periodic evaluation of the effectiveness of the CPC

NIOSH does not recommend reuse of CPC unless data are available that demonstrate the efficacy of decontamination procedures in maintaining the effectiveness of the CPC against the chemicals used.

Recommendations for personal protective equipment for chemical hazards are also discussed in the NIOSH Pocket Guide to Chemical Hazards (NIOSH 1985) and the NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards (NIOSH 1981a).

2.3.5.1 Eye and Face Protection

Eye protection or face shields are required when the worker may be injured by flying particles, chips, or sparks or splashed by such liquids as caustics, solvents, and blood or body fluids. Workers should wear protective equipment and clothing when they use machinery that produces dusts and chips or when they handle toxic and corrosive substances. Eye and face shields should provide adequate protection against the particular hazards to which the worker is exposed. The equipment should be easy to clean and disinfect. If workers who wear glasses must also wear goggles, the goggles should fit over the glasses, or the corrective lenses should be mounted behind the protective lenses.

2.3.5.2 Head Protection

Protective head coverings (hard hats) should be required in situations where workers may be struck on the head by falling or flying objects.

2.3.5.3 Foot Protection

Safety shoes are recommended to prevent injury to the feet from falling objects and other hazards. They are particularly important where heavy materials or parts are handled and during shipping and receiving operations. Appropriate footwear with good traction should be worn for wet or slippery areas. Periodic conductivity checks should be made on footwear worn in surgical areas, and disposable shoe covers should be readily available to minimize the potential for static electricity in surgical areas.

2.3.5.4 Gloves, Aprons, and Leggings

Aprons and leggings may be necessary for workers in some operations, depending on the type of hazard. Gloves and arm protectors should be used to prevent lacerations from sharp edges, to prevent contact with chemical and biologic materials, to prevent burns, and to provide shielding from radiation.

2.3.5.5 Hearing Protection

If noise levels exceed current standards, workers must be provided with hearing-protection devices and directed to wear them (29 CFR 1910.95).

2.3.5.6 Respiratory Protection

The employer must provide approved respiratory protection (not surgical masks, which do not provide respiratory protection) when the air is contaminated with excessive concentrations of harmful dusts, fumes, mists, gases, vapors, or microorganisms. Respiratory protection may be used as a control only when engineering or administrative controls are not feasible or while these controls are being developed or installed.

Respirators must be selected by individuals knowledgeable about the workplace environment and the limitations associated with each class of respirator. These individuals must also understand the job tasks to be performed. The correct use of a respirator is as important as the selection process. Without a complete respiratory protection program, workers will not receive the protection anticipated even if the respirator has been correctly chosen. Training, motivation, medical evaluation, fit testing, and a respirator maintenance program are critical elements of an adequate respiratory protection program.

NIOSH has recently updated its "Guide to Industrial Respiratory Protection," which covers the selection, use, and maintenance of respiratory protective devices (NIOSH 1987a). NIOSH has also developed a respirator decision logic (RDL) (NIOSH 1987b) to provide knowledgeable professionals with a procedure for selecting suitable classes of respirators. The RDL identifies criteria necessary for determining the classes of respirators that provide a known degree of respiratory protection for a given work environment, assuming the respirators are used correctly.

The criteria and restrictions on respirator usage in the following two subsections were adapted from the NIOSH RDL (NIOSH 1987).

2.3.5.6.1 Criteria for selecting respirators

The first step is to determine which contaminants the workers are exposed to and then to assemble the necessary toxicologic, safety, and other relevant information for each. This information should include

- General use conditions
- Physical, chemical, and toxicologic properties
- Odor threshold data

- NIOSH recommended exposure limit (REL) or OSHA permissible exposure limit (PEL), whichever is more protective; if no REL or PEL exists, use another recommended exposure limit
- The concentration of the contaminant believed to be immediately dangerous to life or health (IDLH)
- Potential for eye irritation
- Any service life information available for cartridges and canisters

2.3.5.6.2 Restrictions and requirements for all respirator use

The following requirements and restrictions must be considered to ensure adequate protection by the selected respirator under the intended conditions for use:

1. A complete respiratory protection program should be instituted and should include information on regular worker training, use of the respirator in accordance with the manufacturer's instructions, fit testing, environmental monitoring, and maintenance, inspection, cleaning, and evaluation of the respirator. Whenever possible, quantitative evaluation of the protection factor should be performed in the workplace to confirm the actual degree of protection provided by the respirator to each worker. Minimum respiratory protection requirements for air contaminants can be found in the OSHA Safety and Health Standards (29 CFR 1910.134) and in separate sections for specific contaminants (e.g., 1910.1001 for asbestos, and 1910.1025 for lead [see Section 5 of this document]).

2. Qualitative or quantitative fit tests should be conducted as appropriate to ensure that the respirator fits the individual. Periodic evaluations should be made of the effectiveness of each respirator during workplace use. When quantitative fit testing is used, the fit-factor screening level should be chosen with caution, recognizing the uncertainty of its effectiveness (no studies have demonstrated which fit factor values provide adequate acceptance or rejection criteria for quantitative fit screening).

3. Negative-pressure respirators should not be used when facial scars or deformities interfere with the face seal.

4. No respirator (including positive-pressure respirators) should be used when facial hair interferes with the face seal.

5. The respirators should be maintained properly, used correctly, and worn conscientiously.

6. The usage limitations of air-purifying elements (particularly gas and vapor cartridges) should not be exceeded.

7. All respirators must be approved by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA).

8. Workers should be instructed to leave a contaminated area immediately if they suspect that the respirator has failed.

9. Workers are usually not exposed to a single, unvarying concentration of a hazardous substance, but exposures may vary throughout a workshift and from day to day. Thus the highest anticipated concentration should be used to compute the required protection factor for each respirator wearer.

10. Respirator wearers should be aware of the variability in human response to the warning properties of hazardous substances. Thus when warning properties must be relied on as part of a respiratory protection program, the employer should screen each prospective wearer for the ability to detect warning properties of the hazardous substance(s) at exposure concentrations below the REL or PEL, whichever is more protective.

2.3.6 Administrative Controls

Administrative controls involve reducing total daily exposure by removing the worker from the hazardous area for periods of time. These controls are used when it is impractical to reduce exposure levels in the workplace through engineering controls. Administrative controls include (1) rescheduling work to reduce the necessity of rotating shifts, and (2) increasing the frequency of rest periods for persons who work in hot environments.

2.3.7 Medical Monitoring Programs

2.3.7.1 Designing the Program

Appropriate medical procedures exist to evaluate the extent of some workplace exposures (e.g., measuring lead levels in blood) or the effects of exposure on the worker's health (e.g., measuring hearing loss).

Section 5 contains the specific tests appropriate for some common hospital hazards. A medical monitoring program should be designed for each department based on information from safety and health walk-through surveys and industrial hygiene evaluations.

The following questions should be considered for designing medical monitoring programs:

- Are the selected tests specific to the potential exposures? Multiphasic or other general examinations do not target specific hazards.
- Are the selected tests likely to detect adverse health effects? A chest X-ray may detect asbestosis, but asbestosis does not usually develop until 10 or more years after first exposure. Thus a yearly chest X-ray for asbestosis would not help new workers.
- Are there any side effects from the selected test? A chest X-ray may detect some diseases, but it also exposes a worker to radiation. The potential test benefits must be weighed against potential harm.

Specific tests for each job category should be incorporated into the monitoring program of the worker health service. Appendix 2 contains NIOSH recommendations for general safety and health programs, including pre-employment, preplacement, and periodic worker health examinations. In addition, the worker health service may test for conditions that are not necessarily job related but are important for promoting general worker health (e.g., high blood pressure) or are specific to that region (e.g., some hospitals in the southwestern United States routinely administer skin tests for coccidioidomycosis in preplacement physicals).

2.3.7.2 Consent and Confidentiality

Before certain immunizations (e.g., M-M-R [measles, mumps, rubella] and Heptavax-B vaccinations) are given, workers should read, sign, and date informed consent forms designed to alert them to potential side effects. The results of medical testing should be provided directly and confidentially to individual workers. The workers and the safety and health committee should receive group results of testing by work unit (e.g., a table of audiometry results for maintenance workers) to assess the adequacy of worker protection in each unit; individual workers should not be identified.

If a worker must be temporarily or permanently removed from a job for occupational safety or health reasons, the employer should be informed without receiving actual medical information. For example, the notification should read, "Jane Doe may not continue to be exposed to solvents and must be transferred out of the histology section," rather than, "Jane Doe has liver disease and must be transferred out of histology."

2.3.7.3 Recordkeeping

Adequate recordkeeping is very important: (1) to track the safety and health of individual workers and work groups over time, (2) to provide documentation for future evaluations, (3) to help the hospital administration and the safety and health committee identify problem areas, and (4) to measure the effectiveness of safety and health programs.

Many specific OSHA standards (e.g., for ethylene oxide and asbestos) contain detailed provisions for recordkeeping, monitoring, and medical surveillance. These standards should be consulted. In 29 CFR 1904, the Department of Labor also requires all employers covered by the Occupational Safety and Health Act to maintain logs of all occupational injuries and illnesses that have occurred in their workplaces over the last calendar year. These logs (usually OSHA form 200) must be posted in conspicuous places where notices to workers are usually posted. The employer must maintain these records for at least 5 years and provide access to these records for the Secretary of the Department of Health and Human Services. Workers and their representatives also have the right to access these records. When there is a specific standard for a substance, OSHA generally requires that records be maintained for at least the duration of employment plus 30 years.

2.3.7.4 Preplacement Evaluations

Preplacement physical examinations are very important for establishing baselines (pre-exposure measurements of health) and for ensuring that the worker is physically able to perform the job. The Centers for Disease Control (CDC), the American Hospital Association (AHA), and State hospital codes have developed guidelines for screening new hospital workers. The results of the hazard identification procedures outlined in this section should be used to design appropriate preplacement programs. For example, when a person is hired for a position that may require the use of respiratory protection, the preplacement examination should include an evaluation of the worker's physical ability to wear a respirator.

Because many workers do not have general medical examinations regularly, some worker health services in hospitals include a simplified general medical questionnaire and examination when tests are given for more specific reasons. A report of 3,599 preplacement examinations in a large teaching hospital indicated that the most frequent problems involved (1) susceptibility to communicable diseases such as diphtheria or rubella, or (2) the potential for disease transmission, as indicated by tuberculin-positive skin tests, intestinal parasites in stool examinations, positive serological tests for syphilis, or the presence of the hepatitis B surface antigen. The most frequent noninfectious illnesses were hypertension and anemia (Schneider and Dykan 1978).

2.4 OCCUPATIONAL SAFETY AND HEALTH AGENCIES AND ORGANIZATIONS

Several agencies and organizations are involved in promoting safety and health in hospitals, and significant differences exist among state agencies that hold enforcement powers. Federal agencies such as NIOSH help assess potential hazards and make recommendations for correction without the threat of citation or penalty. Private organizations such as the AHA and the National Safety Council (NSC) also develop recommendations and provide materials and assistance. The major agencies and organizations that develop regulations, standards, recommendations, and codes for occupational safety and health in hospitals are described briefly below. Other organizations addressing more specific groups of health professionals (e.g., the College of American Pathologists) are listed in Section 7.

2.4.1 Occupational Safety and Health Administration

The Occupational Safety and Health Administration (OSHA) is responsible for promulgating and enforcing standards in most workplaces, including Federal and private sector hospitals. About half of all States have approved State OSHA plans, which must be at least as effective as Federal plans in providing for safe and healthful employment. State plans may also cover hospitals operated by State and local governments. OSHA offices are listed in Section 7.

OSHA has developed specific standards for hazards such as noise, mercury, ethylene oxide, and asbestos. Also, a general duty clause states that employers must provide their workers with "employment and a place of employment which are free from recognized hazards that are likely to cause death or serious physical harm . . ." (Public Law 91-596).

OSHA has the authority to inspect workplaces in response to requests from workers or as part of targeted or routine inspection schedules. Citations and fines may be imposed for violations discovered during these inspections. OSHA also has a free consultation service that provides employers with evaluations of workplace hazards and advice on control methods without the risk of citations or fines--provided the employer agrees to abate any serious hazards identified during a consultation. OSHA has a referral system for serious violations that are not abated after a consultation visit.

2.4.2 National Institute for Occupational Safety and Health

The National Institute for Occupational Safety and Health (NIOSH) conducts research on workplace hazards and recommends new or improved standards to OSHA. NIOSH also investigates specific workplace hazards in response to requests by workers or employers. Although NIOSH has the same right of entry as OSHA to conduct health hazard evaluations (HHE's), NIOSH can only recommend hazard controls and has no enforcement authority. HHE's can be

particularly useful where the causes of workplace hazards are unknown, where a combination of substances may be causing a problem, or where a newly recognized health effect is suspected for a substance that is already regulated. NIOSH also investigates potential health hazards on an industrywide basis, performs research on methods for controlling safety and health hazards, recommends standards to OSHA for promulgation, publishes and distributes NIOSH studies and investigations, and provides training programs for professionals. For more detailed information on the NIOSH HHE program, refer to A Worker's Guide to NIOSH (NIOSH 1978). NIOSH also assesses and documents new hazard control technology for processes and specific hazards. An article by Kercher and Mortimer (1987) is an example of such an assessment.

In addition to conducting HHE's and control technology assessments, NIOSH investigates the circumstances of fatal accidents and recommends safe work practices and controls to reduce or eliminate hazards.

2.4.3 Centers for Disease Control

The Centers for Disease Control (CDC) is a Federal public health agency based in Atlanta, Georgia. Among other responsibilities, CDC is charged with the surveillance and investigation of infectious diseases in hospitals. CDC collects weekly, monthly, and yearly statistics on many infectious diseases, on control programs and activities for hospital infections, and on new problems as they appear. The Agency is also charged with making recommendations necessary for disease control.

2.4.4 Health Resources and Services Administration

Under the Hill-Burton legislation (Public Law 79-725, as amended), the Health Resources Administration (HRA) (now the Health Resources and Services Administration [HRSA]) published Minimum Requirements of Construction and Equipment for Hospital and Medical Facilities (HRA 1979). Hospitals receiving Federal assistance must comply with these regulations.

2.4.5 Nuclear Regulatory Commission

The Nuclear Regulatory Commission (NRC) adopts and enforces standards for departments of nuclear medicine in hospitals, although some states have agreements with the federal government to assume these responsibilities. In these cases, the responsible state agency is usually the state health department. NRC regulates roentgenogram sources (Title 21) and all radioactive isotope sources except radium (Title 10) (21 CFR 1000-1050 [1985]; 10 CFR 20 and 34 [1985]) but does not have authority to regulate naturally occurring radioactive materials such as radium or radon. The Food

and Drug Administration (FDA) is responsible for those regulations. NRC publishes and continuously revises guides to describe methods acceptable for implementing specific parts of the Commission's regulations. These guides are published and revised continuously.

2.4.6 State, County, and Municipal Health Agencies

With some variation, state health departments adopt and enforce regulations in the following areas: radiation, nuclear medicine, infectious disease control, infectious disease and hazardous waste disposal, and food handling. In some states, the health department and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) (formerly the Joint Commission on Accreditation of Hospitals [JCAH]) accredit hospitals jointly. Both the JCAHO and the State health departments have the patient's rather than the worker's safety and health as their primary concern. Thus the accreditation requirements are not fully developed in the area of worker health protection. County and city health departments also have jurisdiction over food handling and some other hospital functions, and they help evaluate many potential hazards regulated at the state level.

2.4.7 Joint Commission on Accreditation of Healthcare Organizations

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) re-evaluates the accreditation every 3 years for hospitals that choose to apply. The accreditation inspections reflect a primary concern for patients' safety and health, but JCAHO does require hospitals to establish policies and procedures for monitoring and responding to safety and health hazards.

2.4.8 National Fire Protection Association

The National Fire Protection Association Code for Safety to Life from Fire in Buildings and Structures (NFPA 1985) is the most basic and complete code for fire safety in hospitals. OSHA, JCAHO, and HRSA have adopted portions of this and other NFPA codes, although the specific references are often to earlier versions.

2.4.9 National Safety Council

The National Safety Council (NSC) recommends general safety and (in the case of ethylene oxide) health recommendations. The hospital section of NSC is responsible for preparing recommendations for hospitals, whereas the research and development and chemical sections are responsible for laboratory safety guidelines.

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