5. Medical Program

Contents

Introduction

Workers handling hazardous wastes can experience high levels of stress. Their daily tasks may expose them to toxic chemicals, safety hazards, biologic hazards, and radiation. They may develop heat stress while wearing protective equipment or working under temperature extremes, or face life-threatening emergencies such as explosions and fires. Therefore, a medical program is essential to assess and monitor workers' health and fitness both prior to employment and during the course of work; to provide emergency and other treatment as needed; and to keep accurate records for future reference. In addition, OSHA recommends a medical evaluation for employees required to wear a respirator (29 CFR Part 1910.134[b][10]), and certain OSHA standards include specific medical requirements (e.g., 29 CFR Part 1910.95 and 29 CFR Parts 1910.1001 through 1910.1045). Information from a site medical program may also be used to conduct future epidemiological studies; to adjudicate claims; to provide evidence in litigation; and to report workers' medical conditions to federal, state, and local agencies, as required by law.

This chapter presents general guidelines for designing a medical program for personnel at hazardous waste sites. It includes information and sample protocols for pre-employment screening and periodic medical examinations, guidelines for emergency and non-emergency treatment, and recommendations for program recordkeeping and review. In addition, it supplies a table of some common chemical toxicants found at hazardous waste sites with recommended medical monitoring procedures.

The recommendations in this chapter assume that workers will have adequate protection from exposures through administrative and engineering controls, and appropriate personal protective equipment and decontamination procedures, as described elsewhere in this manual. Medical surveillance should be used to complement other controls.

Developing a Program

A medical program should be developed for each site based on the specific needs, location, and potential exposures of employees at the site. The program should be designed by an experienced occupational health physician or other qualified occupational health consultant in conjunction with the Site Safety Officer. The director of a site medical program should be a physician who is board-certified in occupational medicine or a medical doctor who has had extensive experience managing occupational health services. A director and/or examining physician with such qualifications may be difficult to find, due to the shortage of doctors trained in occupational medicine in remote geographic areas where many hazardous waste sites are located. If an occupational health physician is not available, the site medical program may be managed, and relevant examinations performed, by a local physician with assistance from an occupational medicine consultant. These functions may also be performed by a qualified Registered Nurse, preferably an Occupational Health Nurse, under the direction of a suitably qualified physician who has responsibility for the program.[1]

All medical test analyses should be performed by a laboratory that has demonstrated satisfactory performance in an established interlaboratory testing program [1]. The clinical or diagnostic laboratory to which samples are sent should meet either (1) minimum requirements under the Clinical Laboratories Improvement Act of 1967 (42 CFR Part 74 Subpart M Section 263[a]), or (2) the conditions for coverage under Medicare. These programs are administered by the Health Care Financing Administration (HCFA), U.S. Department of Health and Human Services (DHHS).

A site medical program should provide the following components:

- Surveillance:
  - Pre-employment screening.
  - Periodic medical examinations (and followup examinations when appropriate).
  - Termination examination.
- Treatment:
  - Emergency
  - Non-emergency (on a case-by-case basis)
- Recordkeeping.
- Program review.

Table 5-1 outlines a recommended medical program; screening and examination protocols are described in the following sections. These recommendations are based on known health risks for hazardous waste workers, a review of available data on their exposures, and an assessment of several established medical programs. Because conditions and hazards vary considerably at each site, only general guidelines are given.

The effectiveness of a medical program depends on active worker involvement. In addition, management should have a firm commitment to worker health and

[1] Certified, state-licensed (where required) Physician's Assistants may also perform these examinations if a physician is available on the premises.

Table 5-1. Recommended Medical Program

COMPONENT	RECOMMENDED	OPTIONAL
Pre-Employment Screening	• Medical history. • Occupational history. • Physical examination. • Determination of fitness to work wearing protective equipment. • Baseline monitoring for specific exposures.	• Freezing pre-employment serum specimen for later testing (limited to specific situations, see *Baseline Data for Future Exposures* in this chapter).
Periodic Medical Examinations	• Yearly update of medical and occupational history; yearly physical examination; testing based on (1) examination results, (2) exposures, and (3) job class and task. • More frequent testing based on specific exposures.	• Yearly testing with routine medical tests.
Emergency Treatment	• Provide emergency first aid on site. • Develop liaison with local hospital and medical specialists. • Arrange for decontamination of victims. • Arrange in advance for transport of victims. • Transfer medical records; give details of incident and medical history to next care provider.	
Non-Emergency Treatment	• Develop mechanism for non-emergency health care.	
Recordkeeping and Review	• Maintain and provide access to medical records in accordance with OSHA and state regulations. • Report and record occupational injuries and illnesses. • Review Site Safety Plan regularly to determine if additional testing is needed. • Review program periodically. Focus on current site hazards, exposures, and industrial hygiene standards.	

safety, and is encouraged to express this commitment not only by medical surveillance and treatment, but also through management directives and informal encouragement of employees to maintain good health through exercise, proper diet, and avoidance of tobacco, alcohol abuse and drug abuse. In particular, management should:

- Urge prospective employees to provide a complete and detailed occupational and medical history.
- Assure employees of confidentiality.
- Require workers to report any suspected exposures, regardless of degree.
- Require workers to bring any unusual physical or psychological conditions to the physician's attention. Employee training should emphasize that vague disturbances or apparently minor complaints (such as skin irritation or headaches) may be important.

When developing an individual program, site conditions must be considered and the monitoring needs of each worker should be determined based on the worker's medical and occupational history, as well as current and potential exposures on site. The routine job tasks of each worker should be considered. For instance, a heavy equipment operator exposed to significant noise levels would require a different monitoring protocol from a field sample collector with minimal noise exposure. Likewise, an administrator may only need a pre-employment screening for ability to wear personal protective equipment—if this is an occasional requirement—rather than a more comprehensive program.

The potential exposures that may occur at a site must also be considered. While it is often impossible to identify every toxic substance that exists at each hazardous waste site, certain types of hazardous substances or chemicals are more likely to be present than others. Some of these are:

- Aromatic hydrocarbons.
- Asbestos (or asbestiform particles).
- Dioxin.
- Halogenated aliphatic hydrocarbons.
- Heavy metals.
- Herbicides.
- Organochlorine insecticides.
- Organophosphate and carbamate insecticides.
- Polychlorinated biphenyls (PCBs).

Table 5-2 lists these groups, with representative compounds, uses, health effects, and available medical monitoring procedures.

Table 5-2. Common Chemical Toxicants Found at Hazardous Waste Sites, Their Health Effects and Medical Monitoring

HAZARDOUS SUBSTANCE OR CHEMICAL GROUP	COMPOUNDS	USES	TARGET ORGANS	POTENTIAL HEALTH EFFECTS	MEDICAL MONITORING
Aromatic Hydrocarbons	Benzene Ethyl benzene Toluene Xylene	Commercial solvents and intermediates for synthesis in the chemical and pharmaceutical industries.	Blood Bone marrow CNS[a] Eyes Respiratory system Skin Liver Kidney	All cause: CNS[a] depression: decreased alertness, headache, sleepiness, loss of consciousness. Defatting dermatitis. Benzene suppresses bone-marrow function, causing blood changes. Chronic exposure can cause leukemia. Note: Because other aromatic hydrocarbons may be contaminated with benzene during distillation, benzene-related health effects should be considered when exposure to any of these agents is suspected.	Occupational/general medical history emphasizing prior exposure to these or other toxic agents. Medical examination with focus on liver, kidney, nervous system, and skin. Laboratory testing: CBC[b] Platelet count Measurement of kidney and liver function.
Asbestos (or asbestiform particles)		A variety of industrial uses, including: Building Construction Cement work Insulation Fireproofing Pipes and ducts for water, air, and chemicals Automobile brake pads and linings	Lungs Gastrointestinal system	Chronic effects: Lung cancer Mesothelioma Asbestosis Gastrointestinal malignancies Asbestos exposure coupled with cigarette smoking has been shown to have a synergistic effect in the development of lung cancer.	History and physical examination should focus on the lungs and gastrointestinal system. Laboratory tests should include a stool test for occult blood evaluation as a check for possible hidden gastrointestinal malignancy. A high quality chest X-ray and pulmonary function test may help to identify long-term changes associated with asbestos diseases; however, early identification of low-dose exposure is unlikely.
Dioxin (see Herbicides)					
Halogenated Aliphatic Hydrocarbons	Carbon tetrachloride Chloroform Ethyl bromide Ethyl chloride Ethylene dibromide Ethylene dichloride Methyl chloride Methyl chloroform Methylene chloride Tetrachloroethane Tetrachloroethylene (perchloroethylene) Trichloroethylene Vinyl chloride	Commercial solvents and intermediates in organic synthesis.	CNS[a] Kidney Liver Skin	All cause: CNS[a] depression: decreased alertness, headaches, sleepiness, loss of consciousness. Kidney changes: decreased urine flow, swelling (especially around eyes), anemia. Liver changes: fatigue, malaise, dark urine, liver enlargement, jaundice. Vinyl chloride is a known carcinogen; several others in this group are potential carcinogens	Occupational/general medical history emphasizing prior exposure to these or other toxic agents Medical examination with focus on liver, kidney, nervous system, and skin. Laboratory testing for liver and kidney function; carboxyhemoglobin where relevant.

Table 5-2. (cont.)

HAZARDOUS SUBSTANCE OR CHEMICAL GROUP	COMPOUNDS	USES	TARGET ORGANS	POTENTIAL HEALTH EFFECTS	MEDICAL MONITORING
Heavy Metals	Arsenic **Beryllium** Cadmium Chromium Lead Mercury	Wide variety of industrial and commercial uses.	Multiple organs and systems including: Blood Cardiopulmonary Gastrointestinal Kidney Liver Lung CNS[a] Skin	All are toxic to the kidneys. Each heavy metal has its own characteristic symptom cluster. For example, lead causes decreased mental ability, weakness (especially hands), headache, abdominal cramps, diarrhea, and anemia. Lead can also affect the blood-forming mechanism, kidneys, and the peripheral nervous system. Long-term effects[c] also vary. Lead toxicity can cause permanent kidney and brain damage; cadmium can cause kidney or lung disease. Chromium, beryllium, arsenic, and cadmium have been implicated as human carcinogens.	History-taking and physical exam: search for symptom clusters associated with specific metal exposure, e.g., for lead look for neurological deficit, anemia, and gastrointestinal symptoms. Laboratory testing: Measurements of metallic content in blood, urine, and tissues (e.g., blood lead level; urine screen for arsenic, mercury, chromium, and cadmium). CBC[b] Measurement of kidney function, and liver function where relevant. Chest X-ray or pulmonary function testing where relevant.
Herbicides	Chlorophenoxy compounds: 2,4-dichlorophenoxyacetic acid (2,4-D) 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) Dioxin (tetrachlorodibenzo-p-dioxin, TCDD), which occurs as a trace contaminant in these compounds, poses the most serious health risk.	Vegetation control.	Kidney Liver CNS[a] Skin	Chlorophenoxy compounds can cause chloracne, weakness or numbness of the arms and legs, and may result in long-term nerve damage. Dioxin causes chloracne and may aggravate pre-existing liver and kidney diseases.	History and physical exam should focus on the skin and nervous system. Laboratory tests include: Measurement of liver and kidney function, where relevant. Urinalysis.
Organochlorine Insecticides	Chlorinated ethanes: DDT Cyclodienes: Aldrin Chlordane Dieldrin Endrin Chlorocyclohexanes: Lindane	Pest control.	Kidney Liver CNS[a]	All cause acute symptoms of apprehension, irritability, dizziness, disturbed equilibrium, tremor, and convulsions. Cyclodienes may cause convulsions without any other initial symptoms. Chlorocyclohexanes can cause anemia. Cyclodienes and chlorocyclohexanes cause liver toxicity and can cause permanent kidney damage.	History and physical exam should focus on the nervous system. Laboratory tests include: Measurement of kidney and liver function. CBC[b] for exposure to chlorocyclohexanes.

Table 5-2. (cont.)

HAZARDOUS SUBSTANCE OR CHEMICAL GROUP	COMPOUNDS	USES	TARGET ORGANS	POTENTIAL HEALTH EFFECTS	MEDICAL MONITORING
Organophosphate and Carbamate Insecticides	Organophosphate: Diazinon Dichlorovos Dimethoate Trichlorfon Malathion Methyl parathion Parathion Carbamate: Aldicarb Baygon Zectran	Pest control.	CNS[a] Liver Kidney	All cause a chain of internal reactions leading to neuromuscular blockage. Depending on the extent of poisoning, acute symptoms range from headaches, fatigue, dizziness, increased salivation and crying, profuse sweating, nausea, vomiting, cramps, and diarrhea to tightness in the chest, muscle twitching, and slowing of the heartbeat. Severe cases may result in rapid onset of unconsciousness and seizures. A delayed effect may be weakness and numbness in the feet and hands. Long-term, permanent nerve damage is possible.	Physical exam should focus on the nervous system. Laboratory tests should include: RBC[d] cholinesterase levels for recent exposure (plasma cholinesterase for acute exposures). Measurement of delayed neurotoxicity and other effects.
Polychlorinated Biphenyls (PCBs)		Wide variety of industrial uses.	Liver CNS[a] (speculative) Respiratory system (speculative) Skin	Various skin ailments, including chloracne; may cause liver toxicity; carcinogenic to animals.	Physical exam should focus on the skin and liver. Laboratory tests include: Serum PCB levels. Triglycerides and. cholesterol. Measurement of liver function.

[a]CNS = Central nervous system.
[b]CBC = Complete blood count.
[c]Long-term effects generally manifest in 10 to 30 years.
[d]RBC = Red blood count.

In compiling a testing protocol, bear in mind that standard occupational medical tests were developed in factories and other enclosed industrial environments, and were based on the presence of specific identifiable toxic chemicals and the possibility of a significant degree of exposure. Some of these tests may not be totally appropriate for hazardous waste sites, since available data suggest that site workers have low-level exposures to many chemicals concurrently, plus brief high-level exposure to some chemicals [2]. In addition, most testing recommendations, even those for specific toxic substances, have not been critically evaluated for efficacy.

Another important factor to consider is that risk can vary, not only with the type, amount and duration of exposure, but also with individual factors such as age, sex, weight, stress, diet, susceptibility to allergic-type reactions, medications taken, and offsite exposures (e.g., in hobbies such as furniture refinishing and automotive body work).

Pre-Employment Screening

Pre-employment screening has two major functions: (1) determination of an individual's fitness for duty, including the ability to work while wearing protective equipment, and (2) provision of baseline data for comparison with future medical data. These functions are discussed below. In addition, a sample pre-employment examination is described.

Determination of Fitness for Duty

Workers at hazardous waste sites are often required to perform strenuous tasks (e.g., moving 55-gallon drums) and wear personal protective equipment, such as respirators and protective clothing, that may cause heat stress and other problems (see Chapter 8 for details). To ensure that prospective employees are able to meet work requirements, the pre-employment screening should focus on the following areas:

Occupational and Medical History

- Make sure the worker fills out an occupational and medical history questionnaire. Review the questionnaire before seeing the worker. In the examining room, discuss the questionnaire with the worker, paying special attention to prior occupational exposures to chemical and physical hazards.
- Review past illnesses and chronic diseases, particularly atopic diseases such as eczema and asthma, lung diseases, and cardiovascular disease.

- Review symptoms, especially shortness of breath or labored breathing on exertion, other chronic respiratory symptoms, chest pain, high blood pressure, and heat intolerance.
- Identify individuals who are vulnerable to particular substances (e.g., someone with a history of severe asthmatic reaction to a specific chemical).
- Record relevant lifestyle habits (e.g., cigarette smoking, alcohol and drug use) and hobbies.

Physical Examination

- Conduct a comprehensive physical examination of all body organs, focussing on the pulmonary, cardiovascular, and musculoskeletal systems.
- Note conditions that could increase susceptibility to heat stroke, such as obesity and lack of physical exercise.
- Note conditions that could affect respirator use, such as missing or arthritic fingers, facial scars, dentures, poor eyesight, or perforated ear drums.

Ability to Work While Wearing Protective Equipment [3]

- Disqualify individuals who are clearly unable to perform based on the medical history and physical exam (e.g., those with severe lung disease, heart disease, or back or orthopedic problems).
- Note limitations concerning the worker's ability to use protective equipment (e.g., individuals who must wear contact lenses cannot wear full-facepiece respirators).
- Provide additional testing (e.g., chest X-ray, pulmonary function testing, electrocardiogram) for ability to wear protective equipment where necessary.
- Base the determination on the individual worker's profile (e.g., medical history and physical exam, age, previous exposures and testing).
- Make a written assessment of the worker's capacity to perform while wearing a respirator, if wearing a respirator is a job requirement. Note that the Occupational Safety and Health Administration (OSHA) respirator standard (29 CFR Part 1910.134) states that no employee should be assigned to a task that requires the use of a respirator unless it has been determined that the person is physically able to perform under such conditions.

Baseline Data for Future Exposures

Pre-employment screening can be used to establish baseline data to subsequently verify the efficacy of protective measures and to later determine if exposures have adversely affected the worker. Baseline testing may include both medical screening tests and biologic monitoring tests. The latter (e.g., blood lead level) may be useful for ascertaining pre-exposure levels of specific substances to which the worker may be exposed and for which reliable tests are available. Given the problem in predicting significant exposures for these workers, there are no clear guidelines for prescribing specific tests. The following approach identifies the types of tests that may be indicated:

- A battery of tests based on the worker's past occupational and medical history and an assessment of significant potential exposures. See Table 5-3 for examples of tests frequently performed by occupational physicians.
- Standard established testing for specific toxicants in situations where workers may receive significant exposures to these agents. For example, long-term exposure during cleanup of a polychlorinated biphenyls (PCB) waste facility can be monitored with pre-employment and periodic serum PCB testing [4]. Standard procedures are available for determining levels of other substances, e.g., lead, cadmium, arsenic, and organophosphate pesticides.
- Where applicable, pre-employment blood specimens and serum frozen for later testing. (PCBs and some pesticides are examples of agents amenable to such monitoring.)

Table 5-3. Tests Frequently Performed by Occupational Physicians

FUNCTION	TEST	EXAMPLE
Liver:		
General	Blood tests	Total protein, albumin, globulin, total bilirubin (direct bilirubin if total is elevated).
Obstruction	Enzyme test	Alkaline phosphatase.
Cell Injury	Enzyme tests	Gamma glutamyl transpeptidase (GGTP), lactic dehydrogenase (LDH), serum glutamic-oxaloacetic transaminase (SGOT), serum glutamic-pyruvic transaminase (SGPT).
Kidney:		
General	Blood tests	Blood urea nitrogen (BUN), creatinine, uric acid.
Multiple Systems and Organs	Urinalysis	Including color; appearance; specific gravity; pH; qualitative glucose, protein, bile, and acetone; occult blood; microscopic examination of centrifuged sediment.
Blood-Forming Function	Blood tests	Complete blood count (CBC) with differential and platelet evaluation, including white cell count (WBC), red blood count (RBC), hemoglobin (HGB), hematocrit or packed cell volume (HCT), and desired erythrocyte indices. Reticulocyte count may be appropriate if there is a likelihood of exposure to hemolytic chemicals.

Sample Pre-Employment Examination

Occupational and Medical History

- Do a complete medical history emphasizing these systems: nervous, skin, lung, blood-forming, cardiovascular, gastrointestinal, genitourinary, reproductive, ear, nose, and throat.

Physical Examination

Include at least the following:

- Height, weight, temperature, pulse, respiration, and blood pressure.
- Head, nose, and throat.
- Eyes. Include vision tests that measure refraction, depth perception, and color vision. These tests should be administered by a qualified technician or physician. Vision quality is essential to safety, the accurate reading of instruments and labels, the avoidance of physical hazards, and for appropriate response to color-coded labels and signals.
- Ears. Include audiometric tests, performed at 500, 1,000, 2,000, 3,000, 4,000, and 6,000 hertz (Hz) pure tone in an approved booth (see requirements listed in 29 CFR Part 1910.95, Appendix D). Tests should be administered by a qualified technician, and results read by a certified audiologist or a physician familiar with audiometric evaluation. The integrity of the eardrum should be established since perforated eardrums can provide a route of entry for chemicals into the body. The physician evaluating employees with perforated eardrums should consider the environmental conditions of the job and discuss possible specific safety controls with the Site Safety Officer, industrial hygienist, and/or other health professionals before deciding whether such individuals can safely work on site.
- Chest (heart and lungs).
- Peripheral vascular system.
- Abdomen and rectum (including hernia exam).
- Spine and other components of the musculoskeletal system.
- Genitourinary system.
- Skin.
- Nervous system.

Tests

- Blood.
- Urine.
- A 14 x 17-inch posterior/anterior view chest X-ray, with lateral or oblique views only if indicated or if mandated by state regulations. The X-ray should be taken by a certified radiology technician and interpreted by a board-certified or board-eligible radiologist. Chest X-rays taken in the last 12-month period, as well as the oldest chest X-ray available, should be obtained and used for comparison. Chest X-rays should not be repeated more than once a year, unless otherwise determined by the examining physician.

Ability to Perform While Wearing Protective Equipment

To determine a worker's capacity to perform while wearing protective equipment, additional tests may be necessary, for example:

- Pulmonary function testing. Measurement should include forced expiratory volume in 1 second (FEV_1), forced vital capacity (FVC), and FEV_1—to-FVC ratio, with interpretation and comparison to normal predicted values corrected for age, height, race, and sex. Other factors such as FEF, MEFR, MVV, FRC, RV, and TLC[1] may be included for additional information. A permanent record of flow curves should be placed in the worker's medical records. The tests should be conducted by a certified technician and the results interpreted by a physician.
- Electrocardiogram (EKG). At least one standard, 12-lead resting EKG should be performed at the discretion of the physician. A "stress test" (graded exercise) may be administered at the discretion of the examining physician, particularly where heat stress may occur.

Baseline Monitoring

If there is likelihood of potential onsite exposure to a particular toxicant, specific baseline monitoring should be performed to establish data relating to that toxicant.

Periodic Medical Examinations

Periodic Screening

Periodic medical examinations should be developed and used in conjunction with pre-employment screening examinations. Comparison of sequential medical reports with baseline data is essential to determine biologic trends that may mark early signs of adverse health effects, and thereby facilitate appropriate protective measures.

The frequency and content of examinations will vary, depending on the nature of the work and exposures. Generally, medical examinations have been recommended at least yearly. More frequent examinations may be necessary, depending on the extent of potential or actual exposure, the type of chemicals involved, the duration of the work assignment, and the individual worker's profile. For example, workers participating in the cleanup of a PCB-contaminated building were initially examined monthly for serum PCB levels. Review of the data from the first few months revealed no appreciable evidence of PCB exposure. The frequency of PCB testing was then reduced [4]. Periodic screening exams can include:

- Interval medical history, focusing on changes in health status, illnesses, and possible work-related symptoms. The examining physician should have information about the worker's interval exposure history, including exposure monitoring at the job site, supplemented by worker-reported exposure history and general information on possible exposures at previously worked sites.
- Physical examination.

[1] FEF = forced expiratory flow; MEFR = maximal expiratory flow rate; MVV = maximal voluntary ventilation; FRC = functional residual capacity; RV = residual volume; TLC = total lung capacity.

- Additional medical testing, depending on available exposure information, medical history, and examination results. Testing should be specific for the possible medical effects of the worker's exposure. Multiple testing for a large range of potential exposures is not always useful; it may involve invasive procedures (e.g., tissue biopsy), be expensive, and may produce false-positive results.

  Pulmonary function tests should be administered if the individual uses a respirator, has been or may be exposed to irritating or toxic substances, or if the individual has breathing difficulties, especially when wearing a respirator.

  Audiometric tests. Annual retests are required for personnel subject to high noise exposures (an 8-hour, time-weighted average of 85 dBA[1] or more), those required to wear hearing protection, or as otherwise indicated.

  Vision tests. Annual retests are recommended to check for vision degradation.

  Blood and urine tests when indicated.

Sample Periodic Medical Examination

The basic periodic medical examination is the same as the pre-employment screening (see previous section, *Sample Pre-Employment Examination*), modified according to current conditions, such as changes in the worker's symptoms, site hazards, or exposures.

Termination Examination

At the end of employment at a hazardous waste site, all personnel should have a medical examination as described in the previous sections (see *Sample Pre-Employment Examination*). This examination may be limited to obtaining an interval medical history of the period since the last full examination (consisting of medical history, physical examination, and laboratory tests) if all three following conditions are met:

- The last full medical examination was within the last 6 months.
- No exposure occurred since the last examination.
- No symptoms associated with exposure occurred since the last examination.

If any of these criteria are not met, a full examination is medically necessary at the termination of employment.

Emergency Treatment

Provisions for emergency treatment and acute non-emergency treatment should be made at each site. Preplanning is vital.

When developing plans, procedures, and equipment lists, the range of actual and potential hazards specific to the site should be considered, including chemical, physical (such as heat and/or cold stress, falls and trips), and biologic hazards (animal bites and plant poisoning as well as hazardous biological wastes). Not only site workers, but also contractors, visitors, and other personnel (particularly firefighters) may require emergency treatment.

Emergency medical treatment should be integrated with the overall site emergency response program (see Chapter 12). The following are recommended guidelines for establishing an emergency treatment program.

- Train a team of site personnel in emergency first aid. This should include a Red Cross or equivalent certified course in cardiopulmonary resuscitation (CPR), and first-aid training that emphasizes treatment for explosion and burn injuries, heat stress, and acute chemical toxicity. In addition, this team should include an emergency medical technician (EMT) if possible. Table 5-4 lists signs and symptoms of exposure and heat stress that indicate potential medical emergencies.
- Train personnel in emergency decontamination procedures in coordination with the Emergency Response Plan (see Chapter 12 for details).
- Predesignate roles and responsibilities to be assumed by personnel in an emergency.
- Establish an emergency/first-aid station on site, capable of providing (1) stabilization for patients requiring offsite treatment, and (2) general first aid (e.g., minor cuts, sprains, abrasions).

  Locate the station in the clean area adjacent to the decontamination area to facilitate emergency decontamination.

  Provide a standard first-aid kit or equivalent supplies, plus additional items such as emergency/deluge showers, stretchers, portable water, ice, emergency eyewash, decontamination solutions, and fire-extinguishing blankets.

  Restock supplies and equipment immediately after each use and check them regularly.
- Arrange for a physician who can be paged on a 24-hour basis.
- Set up an on-call team of medical specialists for emergency consultations, e.g., a toxicologist, dermatologist, hematologist, allergist, opthalmologist, cardiologist, and neurologist.
- Establish a protocol for monitoring heat stress (see *Monitoring* section of Chapter 8).
- Make plans in advance for emergency transportation to, treatment at, and contamination control procedures for a nearby medical facility.

  Educate local emergency transport and hospital personnel about possible medical problems on site; types of hazards and their consequences; potential for exposure; scope and function of the site medical program.

  Assist the hospital in developing procedures for site-related emergencies. This will help to protect hospital personnel and patients, and to minimize delays due to concerns about hospital safety or contamination.

  For specific illnesses or injuries, provide details of the incident and the worker's past medical history to the appropriate hospital staff. This is especially crucial when specific medical treatment is required, e.g., for exposure to cyanide or organophosphate pesticides.

[1] dBA = decibels on A-weighted scale (29 CFR Part 1910.95).

Table 5-4. Signs and Symptoms of Chemical Exposure and Heat Stress that Indicate Potential Medical Emergencies

TYPE OF HAZARD	SIGNS AND SYMPTOMS
Chemical Hazard	Behavioral changes
	Breathing difficulties
	Changes in complexion or skin color
	Coordination difficulties
	Coughing
	Dizziness
	Drooling
	Diarrhea
	Fatigue and/or weakness
	Irritability
	Irritation of eyes, nose, respiratory tract, skin, or throat
	Headache
	Light-headedness
	Nausea
	Sneezing
	Sweating
	Tearing
	Tightness in the chest
Heat Exhaustion	Clammy skin
	Confusion
	Dizziness
	Fainting
	Fatigue
	Heat rash
	Light-headedness
	Nausea
	Profuse sweating
	Slurred speech
	Weak pulse
Heat Stroke (may be fatal)	Confusion
	Convulsions
	Hot skin, high temperature (yet may feel chilled)
	Incoherent speech
	Convulsions
	Staggering gait
	Sweating stops (yet residual sweat may be present)
	Unconsciousness

Depending on the site's location and potential hazards, it may be important to identify additional medical facilities capable of sophisticated response to chemical or other exposures.

- Post conspicuously (with duplicates near the telephones) the names, phone numbers, addresses, and procedures for contacting:

  On-call physicians.
  Medical specialists.
  Ambulance services.
  Medical facility(ies).
  Emergency, fire, and police services.
  Poison control hotline.

- Provide maps and directions.
- Make sure at least all managers and all individuals involved in medical response know the way to the nearest emergency medical facility.
- Establish a radiocommunication system for emergency use.
- Review emergency procedures daily with all site personnel at safety meetings before beginning the work shift.

Non-Emergency Treatment

Arrangements should be made for non-emergency medical care for hazardous waste site workers who are experiencing health effects resulting from an exposure to hazardous substances. In conjunction with the medical surveillance program, offsite medical care should ensure that any potential job-related symptoms or illnesses are evaluated in the context of the worker's exposure. Offsite medical personnel should also investigate and treat non-job-related illnesses that may put the worker at risk because of task requirements (e.g., a bad cold or flu that might interfere with respirator use). A copy of the worker's medical records should be kept at the site (with provisions for security and confidentiality) and, when appropriate, at a nearby hospital. Treating physicians should have access to these records.

Medical Records

Proper recordkeeping is essential at hazardous waste sites because of the nature of the work and risks: employees may work at a large number of geographically separate sites during their careers, and adverse effects of long-term exposure may not become apparent for many years. Records enable subsequent medical care providers to be informed about workers' previous and current exposures.

Occupational Safety and Health Administration (OSHA) regulations mandate that, unless a specific occupational safety and health standard provides a different time period, the employer must:

- Maintain and preserve medical records on exposed workers for 30 years after they leave employment (29 CFR Part 1910.20).

- Make available to workers, their authorized representatives, and authorized OSHA representatives the results of medical testing and full medical records and analyses (29 CFR Part 1910.20).
- Maintain records of occupational injuries and illnesses and post a yearly summary report (29 CFR Part 1904).

Program Review

Regular evaluation of the medical program is important to ensure its effectiveness. Maintenance and review of medical records and test results aid medical personnel, site officers, and the parent company and/or agency managers in assessing the effectiveness of the health and safety program. The Site Safety Officer, medical consultant, and/or management representative should, at least annually:

- Ascertain that each accident or illness was promptly investigated to determine the cause and make necessary changes in health and safety procedures.
- Evaluate the efficacy of specific medical testing in the context of potential site exposures.
- Add or delete medical tests as suggested by current industrial hygiene and environmental data.
- Review potential exposures and Site Safety Plans at all sites to determine if additional testing is required.
- Review emergency treatment procedures and update lists of emergency contacts.

References

1. Proficiency Testing Programs

   Division of Technology Evaluation and Assistance
   Laboratory Program Office
   Center for Disease Control
   Atlanta, GA 30333

   College of American Pathologists
   7400 N. Skokie Blvd.
   Skokie, IL 60077

   American Association for Bioanalysts
   205 W. Levee Street
   Brownsville, TX 78520

2. Costello, R.J. 1983. U.S. Environmental Protection Agency Triangle Chemical Site, Bridge City, Texas. NIOSH Health Hazard Evaluations Determination Report, HETA 83-417-1357.

3. ANSI. 1984. American National Standard for Respiratory Protection. ANSI Z88.6-1984. American National Standards Institute, 1430 Broadway, New York, NY 10018.

4. Gleit, A.; Cohen, A.G.; Chase, K.H.; and J. Toth. 1985. Summary Report of the Medical Surveillance Program for the Binghamton State Office Building Decontamination Project. Prepared for Versar New York, Inc.