**Agency for Toxic Substances and Disease Registry**
**Case Studies in Environmental Medicine**
**Taking an Exposure History**

Course: **WB 1109**
CE Original Date: **May 12, 2008**
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**Table of Contents**



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| **Key Concepts** | • Because many environmental diseases either manifest as common medical problems or have nonspecific symptoms, an exposure history is vital for correct diagnosis.<br>• By taking a thorough exposure history, the primary care clinician can play an important role in detecting, treating, and preventing disease due to toxic exposure |
| **About This and Other Case Studies in Environmental Medicine** | This educational case study document is one in a series of self-instructional publications designed to increase the primary care provider's knowledge of hazardous substances in the environment and to promote the adoption of medical practices that aid in the evaluation and care of potentially exposed patients. The complete series of Case Studies in Environmental Medicine is located on the ATSDR Web site at URL: www.atsdr.cdc.gov/csem/. In addition, the downloadable PDF version of this educational series and other environmental medicine materials provides content in an electronic, printable format, especially for those who may lack adequate Internet service. |

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| **How to Apply for and Receive Continuing Education Credit** | See Internet address www2.cdc.gov/atsdrce/ for more information about continuing medical education credits, continuing nursing education credits, and other continuing education units. |
| **Acknowledgements** | We gratefully acknowledge the work that the medical writers, editors, and reviewers have provided to produce this educational resource. Listed below are those who have contributed to development of this version of the Case Study in Environmental Medicine.<br><br>**Please Note**: Each content expert for this case study has indicated that there is no conflict of interest to disclose that would bias the case study content.<br><br>**ATSDR Authors:** Dianyi Yu, MD<br><br>**ATSDR Planners:** Valerie J. Curry, MS; John Doyle, MPA; Obaid Faroon, DVM, PhD.; Bruce J. Fowler, Ph.D.; Kimberly Gehle, MD; Sharon L. Hall, Ph.D.; Michael Hatcher, DrPH; Kimberly Jenkins, BA; Ronald T. Jolly; Delene Roberts, MSA; Oscar Tarrago, MD; Brian Tencza, MS; Dianyi Yu, MD.<br><br>**ATSDR Commenters**: Obaid Faroon, DVM, PhD.; Dianyi Yu, MD., Ph.D.<br><br>**Peer Reviewers:** Obaid Faroon, DVM, PhD.; Environmental Health Scientist, Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine<br><br>**External Peer Reviewers**: Cynthia F. Bearer, M.D., PH.D., FAAP, Rainbow Babies and Children's Hospital, University Hospitals of Cleveland, 11100 Euclid Ave., Cleveland, Ohio 44106-6010; James E. Blessman Jr., MD, M.P.H., Wayne State University, 4201 St. Antoine, UHC 4D, Detroit, MI 48201 |
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Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
Environmental Medicine and Educational Services Branch

## How to Use This Course

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| **Introduction** | The goal of *Case Studies in Environmental Medicine* (CSEM) is to increase the primary care provider's knowledge of hazardous substances in the environment and to help in evaluating and treating potentially exposed patients. This CSEM focuses on taking an exposure history. |
| **Available Versions** | Two versions of the *Taking an Exposure History* CSEM are available.<br>• The HTML version http://www.atsdr.cdc.gov/csem/exphistory/ provides content through the Internet.<br>• The downloadable PDF version provides content in an electronic, printable format, especially for those who may lack adequate Internet service.<br><br>The HTML version offers interactive exercises and prescriptive feedback to the user. |
| **Instructions** | To make the most effective use of this course, we recommend that you<br>• take the initial check to assess your current knowledge about taking an exposure history<br>• read the title, learning objectives, text, and key points in each section<br>• complete the progress check exercises at the end of each section and check your answers<br>• complete and submit your assessment and posttest responses online if you wish to obtain continuing education credit. Continuing education certificates can be printed immediately upon completion. |
| **Instructional Format** | This course is designed to help you learn efficiently. Topics are clearly labeled so that you can skip sections or quickly scan sections you are already familiar with. This labeling will also allow you to use this training material as a handy reference. To help you identify and absorb important content quickly, each section is structured as follows |

| Section Element | Purpose |
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| Title | Serves as a "focus question" that you should be able to answer after completing the section |
| Learning Objectives | Describes specific content addressed in each section and focuses your attention on important messages |
| Text | Provides the information you need to answer the focus question (s) and achieve the learning objectives |
| Key Points | Highlight important issues and help you review |
| Progress Check exercises | Enable you to test yourself to determine whether you have mastered the learning objectives |
| Progress Check answers | Provide feedback to ensure you understand the answers and can locate information in the text |

| **Learning Objectives** | Upon completion of the Taking an Exposure History CSEM, you should be able to |
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| Content Area | Objectives |
|---|---|
| Overview | • explain the importance of taking an exposure history<br>• explain why primary care clinicians should be knowledgeable about the exposure history process<br>• explain why the exposure history taking is important in daily practice |
| Exposure Pathways | • explain how organ systems may be affected by toxic exposures<br>• identify the possible sources of toxicants from indoor air pollution<br>• identify the possible sources of toxicants in the home and environment |
| Questioning the Patient | • describe the components of an exposure history<br>• explain how temporal relationships between patient's symptoms and patient's home or work environment are identified<br>• identify specific questions asked in the work history<br>• evaluate a possible temporal relationship between patient's symptoms and patient's workplace<br>• identify specific questions asked in the environmental history<br>• evaluate a possible temporal relationship between patient's symptoms and patient's home and surrounding environment<br>• explain why patients need to provide detailed information about their past and current exposures from their jobs and homes |
| Summary | • recognize resources available that help identify toxicants<br>• explain to the patients why they need to provide all the detailed information about their past and current exposures from their jobs and homes |

## Initial Check

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| **Instructions** | This Initial Check will help you assess your current knowledge about taking an exposure history. To take the Initial Check, read the case below, and then answer the questions that follow. |
| **Case Study** | On Tuesday afternoon, a 52-year-old man with previously diagnosed coronary artery disease controlled by nitroglycerin describes episodes of recurring headache for the past three weeks. Mild nausea often accompanies the headache; there is no vomiting. He describes a dull frontal ache that is not relieved by aspirin. The patient states that the headaches are sometimes severe; at other times they are a nagging annoyance. The durations range from half an hour to a full day.<br><br>His visit was also prompted by a mild angina attack that he suffered this past weekend shortly after he awoke on Sunday morning. He has experienced no further cardiac symptoms since that episode.<br><br>History of previous illness indicates that the patient was diagnosed with angina pectoris three years ago. He has been taking 0.4 milligrams (mg) nitroglycerin sublingually prophylactically before vigorous exercise. He also takes one aspirin every other day. He has been symptom-free for the past 2½ years.<br><br>Sublingual nitroglycerin relieved the pain of the Sunday morning angina attack within several minutes.<br><br>The patient does not smoke and rarely drinks alcohol. He is a trim man with a slightly ruddy complexion.<br><br>At present, he is afebrile, and his vital signs are as follows<br><br>• blood pressure 120/85<br>• pulse 80<br>• respirations 20<br><br>Physical exam is normal.<br><br>The results of an electrocardiogram (ECG) with a rhythm strip performed in your office are unremarkable.<br><br>Subsequent laboratory testing reveals normal blood lipids, cardiac enzymes, complete blood cell count (CBC), sedimentation rate, glucose, creatinine, and thyroid function. |

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| **Initial Check Questions** | 1. What would you include in the patient's problem list?<br><br>2. What would you include in the differential diagnosis?<br><br>3. What additional information would you seek to assist in the diagnosis? |
| **Initial Check Answers** | 1. The patient's problem list includes recurrent headache and nausea, and unstable angina pectoris.<br><br>2. The patient's differential diagnosis of chest pain includes myocardial infarction. The differential diagnosis of headache and nausea includes viral syndrome, tension headaches, migraine, brain tumor, tooth or sinus problems, psychogenic headache, medication reaction (nitroglycerin can cause headaches), and exposure to toxicants (carbon monoxide, solvents).<br><br>3. The additional information sought to make a diagnosis would include all aspects of a work and environmental exposure history. |

## What Is the Purpose of Taking an Exposure History?

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| **Learning Objectives** | Upon completion of this section, you will be able to<br><br>• explain the importance of taking an exposure history. |
| **Purpose** | Most environmental and occupational diseases either manifest as common medical problems or have nonspecific symptoms. Yet environmental factors rarely enter into the clinician's differential diagnosis. As a result, clinicians miss the opportunity to make correct diagnoses that might influence the course of disease in some afflicted individuals (by stopping exposure) and that might prevent disease in others (by avoiding exposure) (Goldman and Peters 1981).<br><br>What can a clinician do to improve recognition of disease related to current or past exposures? First, one must be suspicious and think about the possibility of environmental factors of disease. Next, one needs to incorporate an exposure history questionnaire into the practice.<br><br>The purpose of this case study is not to demonstrate all exposure possibilities but rather to illustrate the principles and process of investigating the etiology. |
| **Exposure Factors *vs.* Etiology** | The preceding case study describes a patient with angina. He has new, nonspecific symptoms of headache and nausea.<br><br>Suppose this patient lived near a hazardous waste site.<br><br>• Would your differential diagnosis change?<br>• If the patient refinished furniture as a hobby, would you consider this important?<br>• Is there a connection between his headaches and cardiac symptoms?<br>• How would you investigate the possible correlation?<br>• Could he be exposed to chemicals in his workplace?<br><br>Each of these factors could play a role in the etiology of this patient's illness; each exposure could cause disease. |
| **Three Scenarios** | The patient described in the case study—a 52-year-old male with angina—is portrayed in three scenarios throughout this document. An exposure history provides clues that prompt the clinician to investigate the possibility of toxic exposure.<br><br>• **Scenario 1:** This patient is an accountant who has had the same job and the same residence for many years.<br>• **Scenario 2:** This patient owns a commercial cleaning service and uses cleaning products at various industrial and commercial sites.<br>• **Scenario 3:** This patient is a retired advertising copywriter who lives in the vicinity of an abandoned industrial complex. |

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| **Etiologic Diagnosis** | Most environmental and occupational diseases either manifest as common medical problems or have nonspecific symptoms (*e.g.*, headache, difficulty concentrating, behavioral problems, rashes, asthma, angina, myalgia, difficulty conceiving, spontaneous abortion) (Amdur MO 1991; Wigle D 2000; Marshall, Weir *et al.* 2002).<br><br>Etiology distinguishes a disorder as an environmental illness.<br><br>Unless an exposure history is pursued by the clinician, the etiologic diagnosis might be missed, treatment may be inappropriate, and exposure can continue. |

**Table 1. Examples of Environmental Causes of Medical Problems** (Goldman and Peters 1981)

| Symptoms and Diseases | Agent | Potential Exposures |
|---|---|---|
| **Immediate or Short-term Effects** | | |
| dermatoses (allergic or irritant) | metals (chromium, nickel), fibrous glass, solvents, caustic alkali, soaps | electroplating, metal cleaning, plastics, machining, leather tanning, housekeeping |
| headache | carbon monoxide, solvents | firefighting, automobile exhaust, wood finishing, dry cleaning |
| acute psychoses | lead, mercury, carbon disulfide | removing paint from old houses, fungicide, wood preserving, viscose rayon industry |
| asthma or dry cough | formaldehyde, toluene diisocyanate, animal dander | textiles, plastics, polyurethane kits, lacquer, animal handler |
| pulmonary edema, pneumonitis | nitrogen oxides, phosgene, halogen gases, cadmium | welding, farming, chemical operations, smelting |
| cardiac arrhythmias | solvents, fluorocarbons | metal cleaning, solvents use, refrigerator maintenance |
| angina | carbon monoxide, methylene chloride | car repair, traffic exhaust, foundry, wood finishing |
| abdominal pain | lead | battery making, enameling, smelting, painting, welding, ceramics, plumbing |
| hepatitis (may become a long-term effect) | halogenated hydrocarbons (*e.g.*, carbon tetrachloride) | solvents use, lacquer use, hospital workers |

| Latent or Long-term Effects | | |
|---|---|---|
| chronic dyspnea, pulmonary fibrosis | asbestos, silica, beryllium, coal, aluminum | mining, insulation, pipefitting, sandblasting, quarrying, metal alloy work, aircraft or electrical parts |
| chronic bronchitis, emphysema | cotton dust, cadmium, coal dust, organic solvents, cigarettes | textile industry, battery production, soldering, mining, solvent use |
| lung cancer | asbestos, arsenic, nickel, uranium, coke-oven emissions | insulation, pipefitting, smelting, coke-ovens, shipyard workers, nickel refining, uranium mining |
| bladder cancer | β-naphthylamine, benzidine dyes | dye industry, leather, rubber-workers, chemists |
| peripheral neuropathy | lead, arsenic, hexane, methyl butyl ketone, acrylamide | battery production, plumbing, smelting, painting, shoemaking, solvent use, insecticides |
| behavioral changes | lead, carbon disulfide, solvents, mercury, manganese | battery makers, smelting, viscose rayon industry, degreasing, manufacture/repair of scientific instruments, dental amalgam workers |
| extrapyramidal syndrome | carbon disulfide, manganese | viscose rayon industry, steel production, battery production, foundry |
| aplastic anemia, leukemia | benzene, ionizing radiation | chemists, furniture refinishing, cleaning, degreasing, radiation workers |

**Key Points**

- Unless an exposure history is pursued by the clinician, the etiologic diagnosis might be missed, treatment may be inappropriate, and exposure can continue.

**Progress Check**

1. Which of the following statements about benefits of taking an exposure history are true?

   A. make more accurate diagnoses
   B. prevent the development or exacerbation of environment-related disease
   C. stimulate workplace evaluations and the protection of fellow workers
   D. all of the above.

*To review relevant content, see "Etiologic Diagnosis" in this section.*

## What Role Can Primary Care Clinicians Play in Detecting, Treating, and Preventing Disease Resulting from Toxic Exposures?

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| **Learning Objectives** | Upon completion of this section, you will be able to<br>• explain why primary care clinicians should be knowledgeable about the exposure history process. |
| **What Happens in the Clinical Setting** | Most people with illness caused or exacerbated by exposure to hazardous substances obtain their medical care from clinicians who are not specialists in either environmental or occupational medicine.<br><br>Consideration of environmental factors rarely enters into the clinician's history taking or diagnosis (Marshall, Weir *et al.* 2002).<br><br>In a study of a primary care practice in an academic setting, only 24% of 625 charts reviewed included any mention of the patient's occupation; only 2% included information about toxic exposure, duration of present employment, and former occupations (Anonymous 1993).<br><br>A chart review of 2922 histories taken by 137 third-year medical students showed that smoking status was documented in 91% of cases, occupation in 70% and specific occupational exposures in 8.4%. Patients less than 40 years of age and women were significantly less likely than older patients or men to have their occupation and industry noted (McCurdy, Morrin *et al.* 1998; Marshall, Weir *et al.* 2002).<br><br>Findings from another recent study showed that work-related issues might not be adequately addressed or documented in the provider's clinical notes and that opportunities for preventive care relating to work-related injuries and illnesses may not be realized in the primary care setting (Thompson, Brodkin *et al.* 2000). |
| **What Clinicians Need to Do** | The single most important aspect of the approach to patients with potential occupational or environmental disease is to have a high index of suspicion and to follow through on that suspicion (Frank AL 2000).<br><br>Although many clinicians recognize the importance of taking a work and exposure history to evaluate certain problems, most have had little training or practice in doing so (Becker 1982; Pope AM and Rall DP 1995; Merritt 1999; Frank AL 2000; Kilpatrick, Frumkin *et al.* 2002).<br><br>There are numerous resources available to the practitioners willing to spend the time and effort needed to better understand certain environmental health dilemmas.<br><br>Extensive knowledge of toxicology is not needed to diagnose environmental and occupational disease. The same criteria are employed as those used in diagnosing other medical problems—history, including onset and temporal pattern of symptoms and palliative and provocative factors; physical examination; and laboratory results. |

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| | If necessary, consultation with other health professionals such as industrial hygienists or environmental and occupational physicians may facilitate the gathering of helpful information concerning exposures.<br><br>In addition to current exposures, the clinician must consider the long-term or latent effects of past exposures to agents such as asbestos, radiation, and chemical carcinogens. |
| **Exposure History Form** | The exposure history form, (see Appendix I) which can be completed by the clinician or by the patient (to save staff time), will guide the clinician through various aspects of this process.<br><br>The form elicits many important points of an exposure history, including job descriptions and categories associated with hazardous substances, physical, and biologic agents; and temporal and activity patterns related to environmental and occupational disease.<br><br>The form explores past and current exposures. |
| **Process Takes Just a Few Minutes** | Taking an exposure history requires only a few minutes of the clinician's time and can be abbreviated, expanded, or focused according to the patient's signs and symptoms.<br><br>The exposure history form is designed for quick scanning of important details and can be copied and used for a permanent database as well as for the investigation of current problems.<br><br>An exposure history should be taken on every patient. It is of particular importance if the patient's illness occurs at an atypical age or is unresponsive to treatment. |
| **Use Sound Judgment** | The diagnosis of environmental or occupational disease cannot always be made with certainty. Sound clinical judgment must be used, and common etiologies should be considered. The multi-factorial nature of many conditions, particularly chronic diseases, must not be overlooked.<br><br>The clinician must also keep in mind that many organ systems are affected by toxic exposure (**Table 1**). Exposure and effects can be acute or chronic. The latency period from exposure to manifestation of disease can vary, ranging from immediate to delayed (hours or days) to prolonged (decades). |
| **Conclusion** | With practice using the exposure history form and a network of referrals, the primary care clinician can play an important role in detecting, treating, and preventing disease resulting from toxic exposures. |
| **Key Points** | • An exposure history should be taken on every patient.<br>• With practice using the exposure history form and a network of referrals, the primary care clinician can play an important role in detecting, treating, and preventing disease resulting from toxic exposures. |

**Progress Check**

2. Which of the following statements is true?

   A. Taking an exposure history requires lots of the clinician's time.
   B. Extensive knowledge of toxicology is needed to diagnose environmental and occupational disease.
   C. The primary care clinician can play an important role in detecting, treating, and preventing disease resulting from toxic exposures.
   D. Most people with illness caused or exacerbated by exposure to hazardous substances obtain their medical care from specialists in either environmental or occupational medicine.

   *To review relevant content, see "Key Points" in this section.*

3. Exposure history taking is an important component in daily clinical settings because

   A. The etiologic diagnosis might be missed without an exposure history.
   B. The treatment may be inappropriate without an exposure history.
   C. The exposure can continue without an exposure history.
   D. all of the above.

   *To review relevant content, see "Conclusion" in this section.*

## Which Organ Systems Are Affected By Toxic Exposure?

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| **Learning Objective** | Upon completion of this section, you will be able to<br><br>• explain what organ systems are often affected by toxic exposure. |
| **Introduction** | All organ systems (**Table 2**) can be targets of toxic exposures. Different toxins affect various and differing organ systems (Pope AM and Rall DP 1995). |
| **Respiratory** | The respiratory system is both a target organ and a portal of entry for toxicants. Asthma morbidity and death from asthma are increasing. More than 100 toxicants cause asthma, and many more can exacerbate it (Rom 1998). |
| **Skin** | Irritant and allergic contact dermatitis account for 90% of occupational skin disorders. Other skin disorders with occupational/environmental exposure etiologies include pigment alterations, chloracne, urticaria, and malignant neoplasms (Levy BS and Wegman DH 2000). |
| **Liver and Kidney** | Symptoms of liver disease due to toxic exposure can mimic viral hepatitis. About 4,000 new cases of renal disease of unknown etiology are diagnosed annually. Organic solvents and heavy metals are two classes of toxicants known to adversely affect renal function (Pope AM and Rall DP 1995). |
| **Central Nervous System** | Neurotoxicants can cause peripheral neuropathy, ataxia, parkinsonism, seizures, coma, and death. Many chemicals cause mild central nervous system depression that may be misdiagnosed as intoxication and, if undetected, can progress to psychoses or dementia. Sensory impairment can also be caused by exposure to toxicants (*e.g.*, visual disturbances caused by methanol) and physical agents (*e.g.*, hearing impairment caused by loud noise) (Pope AM and Rall DP 1995; Rom 1998). |
| **Reproductive** | Toxicants that target the female reproductive system can cause a wide variety of adverse effects. Changes in sexual behavior, onset of puberty, cyclicity, fertility, gestation time, pregnancy outcome, and lactation as well as premature menopause are among the potential manifestations of female reproductive toxicity. Exposure to lead, for example, can result in menstrual disorders and infertility.<br><br>Toxicants that target the male reproductive system can affect sperm count or shape, alter sexual behavior, and/or increase infertility. Carbon disulfide, for example, is known to disrupt male reproductive health. |
| **Cardiovascular and Hematologic** | The cardiovascular and hematologic systems are frequent targets of toxicants. Cardiovascular changes, as well as exacerbation of preexisting cardiovascular conditions, can result from exposure to noise and to chemicals such as carbon monoxide and tobacco smoke. Benzene can cause bone marrow changes leading to aplastic anemia, acute leukemia, and chronic myelogenous leukemia (Pope AM and Rall DP 1995; Rom 1998). |

**Table 2. Organ Systems Often Affected by Toxic Exposure**

| Organ/System | Exposure Risks |
|---|---|
| respiratory | **asbestos**, **radon**, cigarette smoke, glues |
| skin | **dioxin**, nickel, **arsenic**, **mercury**, cement (**chromium**), **polychlorinated biphenyls** (**PCBs**), glues, rubber cement |
| liver | **carbon tetrachloride**, **methylene chloride**, **vinyl chloride** |
| kidney | **cadmium**, **lead**, **mercury**, **chlorinated hydrocarbon solvents** |
| cardiovascular | carbon monoxide, noise, tobacco smoke, physical stress, carbon disulfide, **nitrates**, **methylene chloride** |
| reproductive | **lead**, carbon disulfide, **methylmercury**, ethylene dibromide |
| hematologic | **arsenic**, **benzene**, **nitrates**, **radiation** |
| neuropsychological | **tetrachloroethylene**, **mercury**, **arsenic**, **toluene**, **lead**, **methanol**, noise, **vinyl chloride** |
| | **Bold type** indicates that the substance is covered in one of the *Case Studies in Environmental Medicine*. |

**Key Points**

- All organ systems can be targets of toxic exposures.

**Progress Check**

4. Which of the following toxicants are well known to adversely affect renal function?

   A. asbestos and tobacco smoke
   B. organic solvents and heavy metals
   C. carbon monoxide and nitrates
   D. noise and vinyl chloride

   *To review relevant content, see "Table 2. Organ Systems Often Affected by Toxic Exposure" in this section.*

## What Are the Possible Sources of Indoor Air Pollution?

**Learning Objectives**

Upon completion of this section, you will be able to

- identify the possible sources of toxicants from indoor air pollution.

**Introduction**

Studies from the U.S. and Europe show that persons in industrialized nations spend more than 90 percent of their time indoors. The concentrations of many pollutants indoors exceed those outdoors. The clinician should consider the following possible sources of indoor air pollution, when eliciting information on exposures

- asbestos
- biologic agents
- building materials
- radon
- tobacco smoke
- wood stoves/gas range/other heating devices

**Environmental Tobacco Smoke**

Environmental tobacco smoke (ETS) is now considered an unacceptable and entirely preventable public health hazard. A recent article provides an overview of the composition of ETS and the major diseases and disorders strongly linked to ETS, emphasizing the effects of ETS on pulmonary function, asthma, and lung cancer (Dhala, Pinsker *et al.* 2006).

The EPA study found that ETS is a mixture of irritating gases and carcinogenic tar particles and is one of the most widespread and harmful air pollutants. Forty-three of the more than 4,700 chemical compounds contained in cigarette smoke are known carcinogens (US Environmental Protection Agency and US Consumer Product Safety Commission 1995).

**Wood Stoves/Gas Ranges/Other Heating Devices**

Aside from environmental tobacco smoke, the major combustion pollutants that may be present at harmful levels in the home or workplace stem chiefly from malfunctioning heating devices, or inappropriate, inefficient use of such devices. Incidents are largely seasonal.

Among possible sources of contaminants: gas ranges that are malfunctioning or used as heat sources; improperly vented fireplaces, furnaces, wood or coal stoves, gas water heaters and gas clothes dryers; and unvented or otherwise improperly used kerosene or gas space heaters.

Gas ranges, which may produce nitrogen oxide, a respiratory irritant, are used for cooking in more than half of the homes in the United States. Proper ventilation and routine inspection and maintenance of the equipment is necessary in residences where wood or gas stoves are used (US Environmental Protection Agency and US Consumer Product Safety Commission 1995).

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| | When not properly maintained and vented, wood stoves emit noxious gases including carbon monoxide, oxides of nitrogen, particulates, and hydrocarbons. Studies have shown that children living in homes heated with wood stoves have a significant increase in respiratory symptoms compared with children living in homes without wood stoves (US Environmental Protection Agency and US Consumer Product Safety Commission 1995). |
| **Building Materials** | Building materials, home improvement products, and textiles used in the home can pose health risks. For example, formaldehyde volatilizes from particle board, insulation materials, carpet adhesives, and other household products. This is a particular problem in the confined spaces of mobile homes. Formaldehyde exposure can cause rhinitis, nausea, dry skin or dermatitis, and upper respiratory and eye irritation. It has also been reported to precipitate bronchospasm in persons who have asthma (US Environmental Protection Agency and US Consumer Product Safety Commission 1995). |
| **Asbestos** | Asbestos was widely used from 1950 to the early 1970s in areas requiring soundproofing, thermal proofing, or durability (*e.g.*, floor and ceiling coverings, heating and water pipe insulation). Intact, undisturbed asbestos-containing materials generally do not pose a health risk. These materials may become hazardous and pose increased risk if they are damaged, are disturbed in some manner, or deteriorate over time and thus release asbestos fibers into building air. Exposure to these fibers has been associated with lung cancer, asbestosis, and mesothelioma.<br><br>The occurrence of disease is influenced by the type of asbestos mineral inhaled, the concentration and dimension of the fibers, and the duration of the exposure.<br><br>Smoking cigarettes in addition to being exposed to asbestos increases the risk of cancer by an order of magnitude above smoking alone or asbestos exposure alone.<br><br>Children may be at greater risk than adults because children have a longer life expectancy than adults, higher activity rates, higher breathing rates, increased amounts of time spent near the floor where fibers accumulate, and a greater likelihood of contact (through curiosity or mischief).<br><br>Further information on the health hazards of asbestos exposure is available in the *Case Studies in Environmental Medicine: Asbestos Toxicity*. |
| **Radon** | Radon, a colorless, odorless gas, is a decay product of uranium and is found in significant concentrations in some areas. Radon itself does no harm, but its progeny attach to airborne particulates such as cigarette smoke and can be inhaled. During subsequent decay, the progeny emit high-energy alpha particles that may injure adjacent bronchial cells, thereby causing lung cancer. Five to 10 percent of single-family homes in the U.S. have been estimated to exceed the EPA radon recommended guideline of four picocuries per liter of air. EPA estimates that approximately 14,000 lung cancer deaths per year are attributable to |

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| | radon (US Environmental Protection Agency and US Consumer Product Safety Commission 1995).<br><br>For further information about radon exposure and its health effects, see *Case Studies in Environmental Medicine: Radon Toxicity*. |
| **Biologic Agents** | Biological air pollutants are found to some degree in every home, school, and workplace. Sources include outdoor air and human occupants who shed viruses and bacteria, animal occupants (insects and other arthropods, mammals) that shed allergens, and indoor surfaces and water reservoirs where fungi and bacteria can grow, such as humidifiers.<br><br>A number of factors allow biological agents to grow and be released into the air. Especially important is high relative humidity, which encourages house dust mite populations to increase and allows fungal growth on damp surfaces. Mite and fungus contamination can be caused by flooding, continually damp carpet (which may occur when carpet is installed on poorly ventilated concrete floors), inadequate exhaust of bathrooms, or kitchen-generated moisture. Appliances such as humidifiers, dehumidifiers, air conditioners, and drip pans under cooling coils (as in refrigerators), support the growth of bacteria and fungi.<br><br>Biological agents in indoor air are known to cause three types of human disease: infections, where pathogens invade human tissues; hypersensitivity diseases, where specific activation of the immune system causes disease; and toxicosis, where biologically produced chemical toxins cause direct toxic effects. In addition, exposure to conditions conducive to biological contamination (*e.g.*, dampness, water damage) has been related to nonspecific upper and lower respiratory symptoms. Evidence is available that shows that some episodes of the group of nonspecific symptoms known as "sick building syndrome" may be related to microbial contamination in buildings. |
| **Key Points** | • It is important to not overlook the potential exposure sources of indoor air pollution. |
| **Progress Check** | 5. Which of following statements is correct?<br><br>A. Smoking cigarettes in addition to being exposed to asbestos increases the risk of cancer by an order of magnitude above smoking alone or asbestos exposure alone.<br>B. Building materials, home improvement products, and textiles used in the home can pose health risks.<br>C. Environmental tobacco smoke (ETS) is a public health hazard.<br>D. all of the above.<br><br>*To review relevant content, see "Asbestos," "Building Materials," and "Environmental Tobacco Smoke" in this section.* |

## What Are Other Toxicants in the Home and Environment?

**Learning Objectives**

Upon completion of this section, you will be able to

- identify the possible sources of toxicants in the home and environment.

**Introduction**

When eliciting information on exposures in the home and environment, the clinician should consider the following possible sources

- common household products
- lead products and waste
- pesticides and lawn care products
- recreational hazards
- soil contamination
- water supply

**Common Household Products**

The following household products are possible sources of toxicants in the home

- aerosol sprays
- air fresheners; stored
- automotive products
- cleansers
- disinfectants
- dry-cleaned clothing
- fuels
- hobby supplies
- moth repellents
- paint strippers and other solvents
- paints
- wood preservatives

Commonly used compounds that can have serious adverse health effects are listed in the table below.

| Compounds | Where Found |
|---|---|
| methylene chloride | • adhesive removers<br>• paint strippers<br>• paint thinners |
| paradichlorobenzene | • air fresheners<br>• moth crystals<br>• toilet bowl deodorizers |
| tetrachloroethylene | • dry cleaning fluids |

Further information is available in Case Studies in Environmental Medicine: Methylene Chloride Toxicity and in Case Studies in Environmental Medicine: Tetrachloroethylene Toxicity.

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| **Levels Often Higher Indoors** | Studies have found that levels of several organics average two to five times higher indoors than outdoors. During and for several hours immediately after certain activities, such as paint stripping, levels may be 1,000 times background outdoor levels (US Environmental Protection Agency and US Consumer Product Safety Commission 1995). |
| **Pesticides and Lawn Care Products** | Pesticides and lawn care products are potentially hazardous, especially to children. Pesticide exposure can occur through dermal contact, inhalation, or ingestion. At least 1,400 active ingredients can be found in more than 34,000 available preparations of insecticides, herbicides, fungicides, and other antibiologic preparations. These agents have different mechanisms of action and toxicity. There are approximately 600 active pesticide ingredients configured in more than 45,000 formulations in use today. Approximately four billion pounds of pesticides are used worldwide in agriculture and in most household gardens (US Environmental Protection Agency 1986).<br><br>Despite the ban on certain pesticides in the U.S., exposure can still occur through improper use, storage, and disposal. Some banned pesticides are used in foreign countries and may return to this country on imported foods. Proper use and storage of household pesticides and proper cleaning of food, especially raw fruits and vegetables, can help protect consumers. |
| **Lead Products and Waste** | Lead poisoning continues to be a significant health problem in the U.S. Although lead was banned from paint for home use in 1972, millions of homes, particularly those built before 1950, still contain high amounts of lead in paint that is peeling and accessible for ingestion by children.<br><br>Lead exposure also occurs through drinking water, especially in homes that have lead-soldered pipes. Significant exposures have occurred in children, particularly ages one to six years, who played in lead-contaminated soil. Acidic foods, such as juices, stored in imported pottery may leach lead from ceramic glazes. Some ceramic glazes used by hobbyists and those in imported pottery also may contain lead.<br><br>People who work in jobs where they are exposed to lead dusts or lead-containing compounds may get lead on their clothing and shoes and bring it into their cars or homes, where children and other family members may be exposed. More than a million U.S. workers are potentially exposed to lead daily in hundreds of occupations such as construction work, radiator repair, metals recycling, battery manufacturing, smelting, and pigments formulating. Good workplace and personal hygiene practices can prevent the majority of these "take-home" exposures. Children may have higher exposures since they are more likely to get lead dust on their hands and then put their fingers or other lead-contaminated objects into their mouths. Consequences of childhood lead exposure have been shown to endure into adulthood.<br><br>For further information see *Case Studies in Environmental Medicine: Lead Toxicity*. |

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| **Recreational Hazards** | Recreational areas and products can pose a hazard to health.<br><br>Fishing and swimming in contaminated lakes and streams can expose participants to toxins contained in polluted waters.<br><br>Wooden playground structures that have not been treated with protective sealants may allow children to have dermal contact with potentially hazardous wood preservatives; these include arsenic-containing compounds, pentachlorophenol, and creosote.<br><br>Some play sands and clays have been reported to contain asbestos-like fibers. Other materials used in arts and crafts involve potentially hazardous silica, talc, solvents, and heavy metals such as lead and cadmium. Toxic materials may be encountered in making stained glass and jewelry, woodworking, model building, and oil and airbrush painting.<br><br>Persons do not need to be directly involved in these activities to become exposed; merely being in the vicinity of a work area may cause exposure. Federal legislation (the Labeling of Hazardous Art Materials Act) requires that all chronically hazardous materials be labeled as inappropriate for children's use.<br><br>For further information<br><br>• *Case Studies in Environmental Medicine: Arsenic Toxicity*<br>• *Case Studies in Environmental Medicine: Asbestos Toxicity*<br>• *Case Studies in Environmental Medicine: Cadmium Toxicity*<br>• *Case Studies in Environmental Medicine: Pentachlorophenol Toxicity* |
| **Water Supply** | Both public water supplies and private wells can be a source of toxic exposure, especially for industrial solvents, heavy metals, pesticides, and fertilizers. For example, an EPA groundwater survey detected trichloroethylene in approximately 10% of the wells tested. It is estimated to be in 34% of the nation's drinking water supplies. Up to 25% of the water supplies have detectable levels of tetrachloroethylene. Methylene chloride may remain in groundwater for years. Some solvents can volatilize from showers and during laundering of clothes, thereby creating a risk of toxicity via inhalation. Nitrates, a common contaminant of rural shallow wells, pose a risk of methemoglobinemia, especially to infants (US Environmental Protection Agency 1985; Agency for Toxic Substances and Disease Registry 1997).<br><br>For further information<br><br>• *Case Studies in Environmental Medicine: Arsenic Toxicity*<br>• *Case Studies in Environmental Medicine: Asbestos Toxicity*<br>• *Case Studies in Environmental Medicine: Lead Toxicity*<br>• *Case Studies in Environmental Medicine: Methylene Chloride Toxicity*<br>• *Case Studies in Environmental Medicine: Nitrates/Nitrites Toxicity*<br>• *Case Studies in Environmental Medicine: Tetrachloroethylene Toxicity*<br>• *Case Studies in Environmental Medicine: Trichloroethylene Toxicity* |

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| **Soil Contamination** | Ingestion of contaminated soil poses a risk of toxicity, especially to children under the age of six, because of natural mouthing or pica behaviors. Lead is a common soil contaminant. Dioxin also adsorbs to soils. Certain pesticides such as chlordane can remain in the soil for years.<br><br>For further information<br><br>• *Case Studies in Environmental Medicine: Arsenic Toxicity*<br>• *Case Studies in Environmental Medicine: Cadmium Toxicity*<br>• *Case Studies in Environmental Medicine: Chlordane Toxicity*<br>• *Case Studies in Environmental Medicine: Chromium Toxicity*<br>• *Case Studies in Environmental Medicine: Dioxin Toxicity*<br>• Case Studies in Environmental Medicine: Lead Toxicity |
| **Key Points** | • The clinician should consider all possible sources when eliciting information on exposure in the home and environment. |
| **Progress Check** | 6. Of the following, which is the correct statement?<br><br>A. Lead is a common soil contaminant.<br>B. Fishing and swimming in contaminated lakes and streams can expose participants to toxins contained in polluted waters.<br>C. Both public water supplies and private wells can be a source of toxic exposure.<br>D. all of the above.<br><br>*To review relevant content, see "Soil Contamination","Recreational Hazards," and "Water Supply" in this section.* |

## What Are the Components of an Exposure History?

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| **Learning Objectives** | Upon completion of this section, you will be able to<br>• describe the components of an exposure history. |
| **Introduction** | An exposure history form has three components: Exposure Survey, Work History, and Environmental History. The main aspects of an exposure history (summarized in **Table 3**) will be elicited through the exposure history form.<br><br>Although a positive response to any question on the form indicates the need for further inquiry, a negative response to all questions does not necessarily rule out a toxic exposure etiology or significant previous exposure. All patients should complete exposure history forms, although the form does not need extensive evaluation in every clinical situation. As in all data-gathering activities, sound clinical judgment must be exercised. |

**Table 3. Components of an Exposure History**

**Part 1. Exposure Survey**

A. Exposures

- Current and past exposure to metals, dust, fibers, fumes, chemicals, biologic hazards, radiation, noise, and/or vibration
- Typical workday (job tasks, location, materials, and agents used)
- Changes in routines or processes
- Other employees or household members similarly affected

B. Health and Safety Practices at Work Site

- Ventilation
- Medical and industrial hygiene surveillance
- Employment exams
- Personal protective equipment (*e.g.*, respirators, gloves, and coveralls)
- Lockout devices, alarms, training, and drills
- Personal habits (Smoke and/or eat in work area? Wash hands with solvents?)

| **Part 2. Work History** |
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| • Description of all previous jobs including short-term, seasonal, and part-time employment and military service<br><br>• Description of present jobs |
| **Part 3. Environmental History** |
| • Present and previous home locations<br><br>• Jobs of household members<br><br>• Home insulating and heating and cooling system<br><br>• Home cleaning agents<br><br>• Pesticide exposure<br><br>• Water supply<br><br>• Recent renovation/remodeling<br><br>• Air pollution, indoor and outdoor<br><br>• Hobbies (*e.g.*, painting, photography, sculpting, welding, woodworking, piloting, restoring automobiles, shooting firearms, creating stained glass, creating ceramics, and gardening)<br><br>• Hazardous wastes/spill exposure<br><br>• Home ventilation/moisture control/flooding |

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| **Key Points** | • Although a positive response to any question on the form indicates the need for further inquiry, a negative response to all questions does not necessarily rule out a toxic exposure etiology or significant previous exposure. |
| **Progress Check** | 7. Which of the following statements is incorrect?<br><br>A. All patients should complete exposure history forms, although the form does not need extensive evaluation in every clinical situation.<br>B. A negative response to all questions should rule out a toxic exposure etiology or significant previous exposure.<br>C. An exposure history form has three components: Exposure Survey, Work History, and Environmental History.<br>D. Hobbies are generally a very important part of environmental history.<br><br>*To review relevant content, see "Introduction" in this section.* |

## What Is Included in the Exposure Survey (Part 1) of an Exposure History Form?

**Learning Objectives**

Upon completion of this section, you will be able to

- explain how possible temporal relationships between patient's symptoms and patient's home or work environment are identified.

**Introduction**

Past and current exposures are recorded on Part 1 of an Exposure History Form, which is designed for easy completion by the patient and a quick scan for pertinent details by the clinician.

The questions investigate

- changes in routines and work site characteristics
- details about known toxicant exposure
- known exposure to metals, dust, fibers, fumes, chemicals, physical agents, and biologic hazards
- other persons affected
- protective equipment use
- temporal patterns and activities

If the patient answers *yes* to one or more questions on Part 1, the clinician must follow up by asking the patient progressively more detailed questions about the possible exposure. Special attention should be directed to the route, dose, duration, and frequency of any identified exposure.

***Scenario 1***

- 52-year-old male accountant with angina
- Chief complaints: headache and nausea

The chart of the patient described in Scenario 1 of the case study reveals that he has worked as an accountant in the same office for the past 12 years. On Part 1 of the completed Exposure History Form, he indicates that no other workers are experiencing similar or unusual symptoms, and he denies recent changes in his job routine.

The patient answered *yes* to these three questions: "Are family members experiencing the same or unusual symptoms?" "Do your symptoms get either worse or better at work?" and "Do your symptoms get either worse or better on weekends?" His explanations of these answers reveal a possible temporal relationship between his symptoms and his home.

*The clue and the clinician/patient dialogue follow.*

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| **Sample Dialogue** | **Clinician:** I see that you noted that your wife is having headaches.<br><br>**Patient:** Yes; frequently. In the last three or four weeks she has had more than usual. She usually has one every month or so; this past month she had three.<br><br>**Clinician:** You also stated that your headaches are worse on weekends.<br><br>**Patient:** Yes, they seem to be. If I wake up on a Saturday or Sunday with a headache, it usually gets worse as the day progresses. In fact, that's usually when I feel nauseated too.<br><br>**Clinician:** Do your symptoms seem to be aggravated by certain activities around the home? A hobby or task?<br><br>**Patient:** No, I usually wake up with the headache. I don't think there's a connection with anything I do.<br><br>**Clinician:** Do your symptoms change at all at work?<br><br>**Patient:** Now that you mention it, if I wake up with a headache, by the time I get to work—it takes about 25 minutes—the headache is usually gone.<br><br>**Clinician:** Your angina attack occurred on a Sunday morning. Describe your weekend leading up to the attack.<br><br>**Patient:** It was a fairly quiet weekend. We had dinner at home Friday evening and just relaxed. On Saturday I spent the day packing old books and storing them in the attic and chopping and stacking firewood. I took one nitroglycerin tablet before doing the heavy work, at about 2:00 PM. Saturday night we had friends over for dinner. We had a fire in the fireplace and visited until about 11:00 PM. I had one glass of wine with dinner. I was beginning to feel a little stiff and sore from the work I did that afternoon. Sunday morning I woke up with a headache again. A few minutes after awakening, while I was still in bed, I had the attack. It was mild, not the crushing pain I've had in the past. I had the headache all day. |
| **Dialogue Analysis and Conclusion** | The preceding dialogue reveals that the patient's symptoms may be associated with the home environment, and his cardiac symptoms, headache, and nausea may be related.<br><br>His symptoms seem to be exacerbated at home and lessen at work. Further questioning is needed to pursue this lead. |

**Further Sample Dialogue**

**Clinician:** What does your wife do for a living?

**Patient:** She's an attorney.

**Clinician:** Do either of you have a hobby?

**Patient:** My hobby is photography. My wife is an avid gardener.

**Clinician:** Do you have your own darkroom?

**Patient:** No, I occasionally use a friend's darkroom, but for the past year I've had my film and prints processed commercially.

**Clinician:** Does your wife use any pesticides or chemicals in the garden?

**Patient:** No, she does strictly organic gardening and uses only natural means of pest control.

**Clinician:** Do you work on your car?

**Patient:** No.

**Clinician:** Have you gotten any new furniture or remodeled your home in the past few years?

**Patient:** No.

**Clinician:** What is your source of heating and cooking in the home?

**Patient:** We have a natural gas, forced-air heating system. We cook with gas and use the fireplace a lot in winter.

**Clinician:** How long have you lived in this home and how old is your furnace?

**Patient:** We've lived there for 23 years. The furnace was replaced about 12 years ago.

**Clinician:** I see that you recently insulated your home. What exactly did you do?

**Patient:** Yes. Last month I added extra insulation to the attic, insulated the crawl space, replaced all the windows with double-paned windows, and weatherized all doorways.

**Clinician:** Have you noticed that the headaches coincide with days you have used the fireplace?

**Patient:** There could be a connection. I definitely use the fireplace more on weekends. This past Saturday I had a fire blazing all day.

**Dialogue Analysis and Conclusion**

A temporal relationship between the headaches and being in the home has been revealed. Some sources of toxicants have been eliminated (formaldehyde and other volatile organic chemicals from new furniture and rugs and toxic chemicals used in hobbies or gardening).

There may be a correlation between symptoms and use of the fireplace. The fireplace could increase negative pressure in the house, causing back drafting of furnace gases. The furnace is old; it may be malfunctioning or producing excessive carbon monoxide. The patient's symptoms, including his angina attack, would be consistent with carbon monoxide poisoning.

Although the patient's symptoms could be associated with his preexisting disease, evidence is strong enough at this point to investigate the possibility of environmental exposure.

It would be appropriate to contact the local gas company to request that it check the furnace and stove for malfunctions and leaks. The fireplace should be checked for proper drafting and for deposits of creosote in the chimney.

A carboxyhemoglobin (COHb) level on the patient may confirm carbon monoxide poisoning. The patient should be advised to ventilate the house until the furnace is checked or to stay out of the house until the gas company deems it safe.

COHb levels are important in diagnosis of carbon monoxide exposure. In nonsmoking patients, a COHb level greater than 5% confirms exposure. (Tomaszewski 1999) A COHb level performed on this patient is 6%, which is high for a nonsmoker. The gas company discovers a cracked heating element in the 12-year-old furnace, which resulted in the circulation of carbon monoxide throughout the house. The use of the fireplace most likely increased the back drafting of fumes. The furnace is replaced, the exposure ceases, and the patient's symptoms abate. He experiences no further cardiac symptoms.

The exposure history form may also alert the clinician to past exposures.

Most often, neither the job title nor the patient's initial description of job duties reveal clues of exposure. It is usually helpful to have a patient describe a routine work day, as well as unusual or overtime tasks. Patients tend to use jargon when describing their jobs. It is the clinician's challenge to persistently question the patient to elucidate possible exposures; it is not necessary to have foreknowledge of a particular trade. Start with general questions and work toward the more specific.

*Part 1 of the form reveals another clue—this patient was exposed to asbestos about 30 years ago. The questioning that the clinician conducts, despite having neither knowledge of the patient's trade nor understanding of the jargon, follows.*

**Further Sample Dialogue about Asbestos Exposure**

**Clinician:** You state here that you were exposed to asbestos, fiberglass, and welding fumes way back in 1976.

**Patient:** Yes, during my days as a shipwright.

**Clinician:** Did you actually handle the asbestos?

**Patient:** No, the pipe laggers were the tradesmen that handled the asbestos.

Oh, you might be setting a bracket or plate next to a pipe and accidentally hit the pipe and dislodge some asbestos, but otherwise, shipwrights didn't handle it. You only had asbestos where there were steam lines from the boiler carrying high-pressure steam to other units like a winch or an auxiliary motor.

**Clinician:** What does a shipwright do? What was a routine day for you?

**Patient:** There was no routine day. The shipwrights were the cream of the journeymen crop; we did everything from outfitting, to establishing the cribbing on the launching gang, to shoring. I worked on the outfitting docks.

We did ship reconversion. I did a lot of work on the forepeak and hawse pipes when I wasn't working below deck.

**Clinician:** What exactly were your tasks below deck?

**Patient:** Most transporters were converted to passenger ships after the war; there was a lot of shifting of equipment and pipes. Basically, the ships were gutted. They would be completely revamped. The shipwrights would do all the woodworking, finish work, plates, and so on. Then, when everything was in place, it would be insulated, and the pipes would be lagged.

**Clinician:** So you worked throughout the ship? And when you finished your tasks, the laggers would come in?

**Patient:** No, no. There might be 10 different tradesmen working in an afterpeak at one time. You'd be working next to welders, flangers, pipe fitters, riveters, laggers; you name it. These conversions were done round-the-clock, seven days a week; it could take a year and a half to complete a conversion. All the tasks were being done simultaneously.

**Clinician:** How long would the lagging take?

**Patient:** The lagging could take six to 10 months, sometimes longer. They were constantly cutting these sections of asbestos to fit the pipes. Then they would attach the sections with a paste and wrap it with asbestos wrapping.

**Clinician:** Could you see the asbestos in the air?

**Patient:** Oh yes. Sometimes it was so thick you couldn't see five feet in front of you. It was white and hung in the welding fumes like smog.

**Clinician:** Did you use any protective equipment? Masks? Respirators?

**Patient:** No. Nobody ever said it was dangerous. We were bothered more by the fiberglass and welding fumes than anything. We thought fiberglass was more dangerous because it was itchy and caused a rash. The air was blue from the welding fumes; if you worked in that for a year, you knew it was affecting you. It inspired me to go back to school and get my accounting degree. But we were blue-collar workers; we were more concerned with welders' flash, a boom breaking, or someone getting crushed between plates than we were with asbestos.

**Clinician:** You worked as a shipwright for six years?

**Patient:** Yes, about that. Five of those years as an outfitter on conversions.

**Dialogue Analysis and Conclusion**

The dialogue in which the clinician engaged the patient neither determines whether the patient's asbestos exposure was significant, nor does it confirm that he suffered adverse effects from the exposure. It is merely a starting point for investigation.

The questioning establishes that approximately 30 years ago this patient received a possibly severe exposure to asbestos fibers for a duration of five or six years. Because quantitative data on this patient's exposure are impossible to obtain, a qualitative description ("Sometimes it was so thick you couldn't see five feet in front of you") can facilitate assessment of the exposure when consulting with an occupational medical specialist.

In this scenario, the disclosure should prompt the clinician to monitor the patient closely for early detection of treatable health effects from asbestos exposure. A chest radiograph would be advised and pulmonary function tests should be considered. Vaccination for influenza may be warranted, depending on the results of the chest radiograph. Consulting an occupational medical specialist could help determine the best way to evaluate and treat this patient.

In this scenario, the clinician successfully diagnosed an illness due to an environmental toxic exposure (carbon monoxide) and noted a significant past exposure (asbestos) that needs follow-up.

Had the clinician failed to pursue an exposure history, the patient's current illness might have been misdiagnosed, treatment might have been inappropriate, or measures might not have been implemented to prevent further carbon monoxide exposure, leading to a risk of continued progression of the angina as well as the possibility of harmful health effects for patients and other residents of the household for carbon monoxide poisoning.

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| **Key Points** | • The exposure survey is designed for easy completion by the patient and a quick scan for pertinent details by the clinician.<br>• It is not necessary to understand the jargon of a particular trade; persistent questioning by the clinician can clarify the tasks involved and reveal possible exposures. |
| **Progress Check** | 8. If the patient answers *yes* to one or more questions on Part 1 of an Exposure History Form, the clinician must<br><br>A. Follow up by asking the patient progressively more detailed questions about the possible exposure.<br>B. Pay special attention to the route, dose, duration, and frequency of any identified exposure.<br>C. Monitor the patient closely for early detection of treatable health effects.<br>D. all of the above.<br><br>*To review relevant content, see "Introduction" in this section.* |

## What Is Included in the Work History (Part 2) of an Exposure History Form?

**Learning Objectives**

Upon completion of this section, you will be able to

- identify specific questions asked in the work history and
- describe on how a seasoned clinician reveals a possible temporal relationship between patient's symptoms and patient's workplace.

**Introduction**

Despite recent declines in occupation-related injuries in the U.S., there remains a high annual incidence of work-related injuries and illnesses, with 495,000 newly reported cases of occupational illnesses and over 6000 occupation-related deaths annually. The U.S. Department of Labor documented 6.6 million injuries and illnesses in 1995 that were related to work activities. An estimated 80% of occupational and environmental-related illnesses are seen by primary care providers. The work history represents the primary tool for recognizing work - related medical injuries and diseases - (Thompson, Brodkin *et al.* 2000).

Part 2 of the Exposure History Form is a comprehensive inventory of hazardous exposures in the patient's present and past occupations.

In evaluating Part 2 of the form, the clinician should note every job the patient has had, regardless of duration. Information on part-time and temporary jobs could provide clues to toxic exposure. Details of jobs may reveal exposures that are not expected based on the job titles. Asking if any processes or routines have been changed recently can be helpful. Military service may have involved toxic exposure.

***Scenario 2***

- 52-year-old male who owns a commercial cleaning service
- Chief complaints: headache and nausea

Scenario 2 involves another instance of a 52-year-old male who is brought in, by his wife, to see his primary care physician for an evaluation.

According to the wife, he has been in excellent health until approximately one week ago, when he began staying up later and later at night. She was initially not too concerned, until he began awakening her to talk about the "revolutionary" new ideas he had about creating an international commercial cleaning service. She notes he was "full of energy" and talked rapidly about many ideas that he had. She became quite concerned when at 3:00 A.M. (European time) her husband called the manager of the rayon mill, who was in Europe, to discuss his ideas. He then began telephoning European banks in an attempt to find partners for his business venture. When his wife confronted him about the inappropriateness of his phone calls, he became enraged and accused her of purposefully attempting to sabotage his venture.

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| | The patient complains of recurring headaches and nausea that started approximately one to two weeks ago and of recent angina attacks. This patient is the owner of a commercial cleaning service and is extremely proud to tell the clinician he performs some of the cleaning himself.<br><br>Questioning the patient extensively about the cleaning products fails to yield any suspicious exposure possibilities. Reviewing Part 2 of the Exposure History Form, the clinician notes detergents, ammonia, and cleansers.<br><br>Pursuance of Part 2, Work History, however, reveals a clue. The clinician's investigation follows. |
| **Sample Dialogue** | **Clinician:** You own a commercial cleaning service?<br><br>**Patient:** Yes, I've been in business for 10 years and I'm going to be world wide. Would you like to purchase stock in my company?<br><br>**Clinician:** We can discuss that a little later. Do you do the cleaning yourself?<br><br>**Patient:** I don't do as much as I used to. I have a crew of about six full-time employees. I do more managing than cleaning, but have been known to roll up my sleeves and pitch in when needed.<br><br>**Clinician:** You clean residences and commercial businesses?<br><br>**Patient:** Yes, I currently have 20 residential accounts and 15 commercial accounts, but have I told you that I will be international?<br><br>**Clinician:** Yes, you did, but right now I'd like to know about the commercial accounts that are local.<br><br>**Patient:** The downtown administrative offices for the school district, several realty offices downtown, and the business offices of the viscose rayon mill. I have six accounts in the Shaw Building downtown (small medical offices) and five retail stores in the Hilltop Mall, but I don't know why you will not listen to how I will revolutionize the commercial cleaning industry. I'm in touch with people that control the world currency markets. I know this because God has spoken to me, telling me how to corner the cleaning market.<br><br>**Clinician:** So your headaches have been occurring for about one week now?<br><br>Have there been any changes in your routine—work or otherwise—in the last week?<br><br>**Patient:** I've worked more hours than usual over the last week. I've been doing a special project for the rayon mill. They built new offices. We moved all the old offices into the new building. That has entailed cleaning and moving furniture, files, books, and exhibits. It's been tedious but I have plenty of energy. Fortunately, most of the staff members have been either out on vacation or at an international conference in Europe, so the building has been empty. |

**Clinician:** Are any of your workers having similar symptoms?

**Patient:** No, nobody else has complained about feeling sick.

**Clinician:** What exactly do they produce at that plant?

**Patient:** They make viscose—transparent paper. I used to work there during summers when I was in college. It was hot, hard work. And the whole place smelled like sulfur—rotten eggs. We used wood pulp cellulose, treated it with acids and other chemicals, and made cellulose filaments. I worked on the blending, ripening, and deaeration process. You know I called the plant manager to help his business grow to international status.

**Clinician:** Can you smell the chemicals in the office building you're working in?

**Patient:** Some days there's a faint odor. Nothing like when I worked on the xanthating process. The business office building is on the northeast end of the complex. It's pretty remote from the processing plant.

**Clinician:** So how many extra hours have you worked the past week?

**Patient:** Only about four to six hours more per day this past week. Also, this past weekend I put in an extra 10 hours. I had to finish setting up the exhibits. I didn't trust the crew to handle the fragile exhibits, so I did the job myself. My crew is good but not as good as me.

**Patient's wife:** Tell the doctor about the bottle you broke!

**Patient:** On Friday, about two weeks ago, I worked late setting up a huge model of the xanthating process. It was tedious work, and I was sort of stressed by the time constraints to get the job done. I had broken a bottle from the exhibit when I disassembled the thing. I'm really not certain that I broke the bottle; it most likely was stored improperly.

**Clinician:** What was in this bottle you broke?

**Patient:** I think it was carbon disulfide. I think I might have put the broken glass and the cleanup rags on the floor of my truck. This stuff had a sweet odor.

**Clinician:** How did you clean it up?

**Patient:** I changed into some protective clothing and a face mask because my eyes and nose burned. There wasn't a lot to clean up because it seemed to evaporate quickly.

**Clinician:** Did you get any of the chemical on you?

**Patient:** I don't think any got on me when the bottle fell, but I'm not certain.

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| | **Clinician:** How much of the chemical was in the bottle? Did you report the accident to anyone at the plant?<br><br>**Patient:** The bottle was about liter size. It wasn't full. There was only a small amount of liquid in the bottle. No, I didn't report the accident. Frankly, I cleaned it up the way I was taught when I worked at the mill before. They know that I'm good. I helped them to become the organization they are today. I'll just talk with the manager when he returns from Europe later this week. |
| **Dialogue Analysis and Conclusion** | The preceding conversation reveals a possible connection with the spill and this patient's symptoms. It warrants further investigation. The results of the patient's physical examination are normal, and the mental status exam shows symptoms and behavior that are typical of a manic episode. The patient is grandiose, irritable, has a marked decreased need for sleep, and is possibly having auditory hallucinations.<br><br>The patient identifies the chemical spilled as carbon disulfide, which is consistent with the patient's symptoms.<br><br>After obtaining permission from the patient, the clinician calls the poison control center to obtain information on carbon disulfide. |
| **Sample Dialogue About the Call** | **Clinician:** My patient is a contract employee at a local textile company. In the process of his work, he broke a bottle that was labeled carbon disulfide. He didn't report the accident and just cleaned it up himself. I am concerned that he may be experiencing health effects from the exposure. He is complaining of nausea, headache, and difficulty sleeping and appears to be exhibiting signs of agitation, grandiose delusions, and hallucinations.<br><br>**Poison Control Center:** It would not surprise me. Carbon disulfide is dangerous stuff. Strict industrial controls are in effect to prevent exposure. This chemical can cause nausea, headache, insomnia, agitation, mania, and hallucinations, all the symptoms your patient is currently experiencing. The acute symptoms are mild to moderate irritation of skin, eyes, and mucous membranes from liquid or concentrated vapors. Skin absorption causes headache, fatigue, unsteady gait, vertigo, hyperesthesia, central nervous system depression, garlicky breath, nausea, vomiting, diarrhea, abdominal pain, coma, convulsion, or death.<br><br>**Clinician:** Can you send me information on carbon disulfide?<br><br>**Poison Control Center:** Certainly. I'll fax you the information on carbon disulfide right away. I suggest that you report the accident to the safety manager at the textile plant. |

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| **Dialogue Analysis and Conclusion** | Consultation with the Occupational and Environmental Physician from the Poison Control Center confirms that this patient's symptoms could indeed be caused by exposure to carbon disulfide.<br><br>The clinician orders a CBC; ECG; urinalysis; liver, kidney and thyroid function tests; blood serology; and an electrolyte panel.<br><br>The clinician received the faxed information and a Material Safety Data Sheet (MSDS) on carbon disulfide (see Appendix II) from the textile plant safety manager.<br><br>The clinician reviews the Health Hazard Data section of the MSDS, and notes all pertinent information in the patient's medical record, along with the prior information faxed from the Poison Control Center.<br><br>Air sampling in the office in which the incident occurred reveals airborne concentrations of 0.8 parts of carbon disulfide per million parts of air (0.8 ppm). The Occupational Safety and Health Administration (OSHA) enforceable standard (permissible exposure limit or PEL) for carbon disulfide in workplace air is 20 parts per million (ppm) averaged over eight hours of exposure. The concentrations were most likely higher at the time of the incident two weeks ago. Also, the acute exposure the patient incurred at the time of the accident has continued to occur for a limited number of hours each week, while he drives with the contaminated rags and bottle in his truck.<br><br>Results of the laboratory tests on this patient are all within normal limits. Other employees at risk of exposure from this spill are also examined; none incurred acute exposure or suffered ill effects. Once the patient's exposure ceases, he improves and experiences no further symptoms. |
| **Key Points** | • Work history is a comprehensive inventory of the patient's occupations, employers, and current and potential exposures in the workplace.<br>• In evaluating patient's work history, the clinician should note every job the patient had, regardless of duration. |
| **Progress Check** | 9. In evaluating work history, the clinician should<br><br>A. note every job the patient had, regardless of duration<br>B. pay attention to the information on part-time, temporary jobs and details of jobs<br>C. ask if any processes or routines have been changed recently can be helpful<br>D. all of the above.<br><br>*To review relevant content, see "Introduction" in this section.* |

## What Is Included in the Environmental History (Part 3) of an Exposure History Form?

**Learning Objective**

Upon completion of this section, you will be able to

- identify specific questions asked in the environmental history
- describe how a seasoned clinician reveals a possible temporal relationship between patient's symptoms and patient's home and surrounding environment

**Introduction**

Part 3 of the Exposure History Form contains questions regarding the home and surrounding environment of the patient. Dialogue with the patient should include queries about the location of the house, the house water supply, and changes in air quality.

Proximity to industrial complexes and hazardous waste sites could result in residents being exposed to toxicants in the air, water, or soil. Contamination in communities is a growing public health concern; affected persons usually seek care from their primary care providers first. If a group of people with similar symptoms and exposures is identified, and an environmental exposure problem is suspected, the clinician should call the state health department or the Agency for Toxic Substances and Disease Registry toll-free at 1-888-42-ATSDR (1-888-422-8737).

Hobbies are potential sources of toxicant exposure. For instance, model building, pottery-making, photography, silk screening, gardening, stained-glass making, and woodworking have all been associated with exposure to hazardous substances. Ask the patient what his or her hobbies are. All members in a household may be exposed to the hazardous substances from one person's hobby; small children may be especially susceptible.

***Scenario 3***

- 52-year-old male, retired advertising copywriter with angina
- Chief complaints: headache and nausea

Scenario 3 involves another patient described in the case study on page seven. In this scenario, the patient has been retired for two years; he took early retirement from a stressful job in advertising shortly after being diagnosed with angina.

The patient's answers to the questions on the Exposure Survey (Part 1 of the form) were *no*: he denies exposure to metals, chemicals, fibers, dust, radiation, and physical and biologic agents; he is not aware of a connection between his symptoms and activity or time; and to his knowledge other persons are not experiencing similar symptoms.

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| | A clue appears on Part 3 of this patient's exposure history—the patient lives two miles from an abandoned industrial site, and prevailing winds blow toward his house.<br><br>In an effort to investigate this lead, the clinician initiates the following dialogue. |
| **Sample Dialogue** | **Clinician:** You state that you live several miles downwind from an abandoned industrial site. Do you know what chemicals might have been used at the site or what type of industry it was?<br><br>**Patient:** There was a fire at the site several weeks ago. The newspaper said that they used methylene chloride to make some kind of plastic. The firefighters found drums of methylene chloride buried on the property.<br><br>**Clinician:** Do you ever smell chemicals in the air?<br><br>**Patient:** Yes, in the mornings when the wind blows from that direction, I smell a sweet odor. My neighbors have mentioned it too. In fact, they told me that the smell is really strong when they do laundry or dishes, and when they shower.<br><br>**Clinician:** Have you smelled it in your water?<br><br>**Patient:** No.<br><br>**Clinician:** What is the source of your water?<br><br>**Patient:** I have city water, but my neighbors have a private well.<br><br>**Clinician:** Do you know if any agency is testing your neighborhood for contamination?<br><br>**Patient:** Not as far as I know. |
| **Dialogue Analysis and Conclusion** | The preceding dialogue has uncovered the possibility that the patient was exposed to a toxicant. Furthermore, this patient may represent an index case; others may also be exposed. To follow up this lead, the clinician contacts the state health department. The health department confirms that the site contains buried drums of methylene chloride and that it is under investigation.<br><br>An industrial hygienist employed by the health department informs the clinician that the methylene chloride can indeed exacerbate signs and symptoms of angina. The odor threshold for the chemicals is 100–300 ppm. An 8-hour exposure to 250 ppm methylene chloride can cause a COHb level of about 8%.<br><br>The laboratory reports that the patient's COHb is 6%, indicating probable exposure to methylene chloride in this nonsmoker. COHb, which forms when methylene chloride metabolizes to carbon monoxide, can be detected in blood at levels of 4% to 9% when ambient air concentrations |

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| | of methylene chloride are about 220 ppm. Many factors can influence body burden, including exposure level and duration, route of exposure, physical activity, and amount of body fat.<br><br>A conference call is made, and the emergency response coordinator, a toxicologist, an industrial hygienist, and a physician discuss the patient's signs and symptoms. The clinician is given the name of the local contact person for the Association of Occupational and Environmental Clinics, who recommends a specialist to provide follow-up care for this patient.<br><br>The health department's tests of ambient air reveal no immediate crisis in the vicinity, although the levels are above background levels; test results of water samples from private wells in the area are pending. ATSDR informs the EPA regional office of the situation. EPA provides immediate assistance to the affected area, cleanup is initiated, and threats to the surrounding population are mitigated. |
| **Key Points** | • Proximity to industrial complexes and hazardous waste sites could result in residents being exposed to toxicants in the air, water, or soil.<br>• Hobbies are potential sources of toxicant exposure. |
| **Progress Check** | 10. Which of the following statement is correct?<br><br>A. Contamination in communities is a growing public health concern; affected persons usually seek care from their primary care providers first.<br>B. If a group of people with similar symptoms and exposures is identified, and an environmental exposure problem is suspected, the clinician should call the EPA.<br>C. Household members are not at risk of exposure to the hazardous substances from one person's hobby.<br>D. None of the above.<br><br>*To review relevant content, see "Introduction" in this section.* |

## Other Resources

| | |
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| **Learning Objective** | Upon completion of this section, you will be able to<br>• describe reference sources available that help identify toxicants |
| **Introduction** | Identifying the hazard, controlling the exposure, and arresting or reversing the progression of the patient's illness are the goals of taking an exposure history.<br><br>Often, patients do not know the chemicals to which they have been exposed although they may know the trade names or slang terms for the chemicals.<br><br>Likewise, household products used by patients may have labeling that is inadequate for proper identification.<br><br>A variety of printed reference sources, including books, journals, and Material Safety Data Sheets (MSDSs), usually provide the quick access to medical and toxicological information for health practitioners. Information can also be obtained from sources such as, poison control centers, government agencies, employers, manufacturers, and unions (Bresnitz, Rest *et al.* 1985). |
| **Material Safety Data Sheet (MSDS)** | The objective of the MSDS is to concisely inform you about the hazards of the materials you work with so that you can protect yourself and respond to emergency situations. The law states that you must have access to MSDSs and be taught to read and understand them.<br><br>The Occupational Safety and Health Administration (OSHA) has developed a right-to-know regulation covering three basic areas<br><br>• the generation and distribution of information about chemical hazards<br>• requirements for the labeling of chemicals used in the workplace<br>• programs for training employees in the safe use of these chemicals<br><br>Many state and local right-to-know laws, however, are more comprehensive than the federal regulation.<br><br>The MSDS is a component of the right-to-know law. Manufacturers and importers are required to provide an MSDS for each hazardous chemical in a shipment. Users of the chemicals must keep copies of MSDSs and make them available to workers, clinicians, and others.<br><br>MSDSs contain information on the chemical properties of the substance, handling precautions, known health effects, and conditions that might worsen with exposure. The information on human health effects, however, can be vague and may have limited clinical value. The MSDS may not provide information on the synergistic effects of multiple chemical exposures. Clinical decisions should not be made solely from information obtained from MSDSs (sample MSDS, see Appendix II). |

**Additional Toxicological Information**

Books and journals provide the most accessible information on toxicological issues. Some sources of information that the clinician can use to identify the chemicals, processes, and hazards of toxic substances are described in the following list.

Daugaard J. Symptoms and signs in occupational disease: a practical guide. Chicago: Year Book Medical Publishers, 1978. *A classification of occupational and environmental diseases according to associated clinical signs and symptoms.*

Etzel RA, editor. Pediatric Environmental Health. 2nd ed. Elk Grove Village, IL: American Academy of Pediatrics; 2003.

Fay BA, Billings CE, editors. Index of signs and symptoms of industrial diseases. Atlanta: US Department of Health and Human Services, 1981. *A guide to occupational and environmental diseases listed by associated clinical signs and symptoms.*

Gosselin RE, Smith RP, Hodge HC, editors. Clinical toxicology of commercial products. Baltimore: Williams & Wilkins, 1984. *A classification of products and the chemicals they contain, including the adverse health effects produced by exposure.*

Hathaway G, Proctor NH, Hughes JP, editors. Proctor and Hughes' chemical hazards of the workplace. 4th ed. New York: Van Nostrand Reinhold, 1996. *A short text summarizing the most important occupational chemical hazards.*

LaDou J. Occupational and environmental medicine. Stamford (CT): Appleton & Lange, 1997. *Aids in the diagnosis, treatment, and remedial measures of occupational injuries and illnesses.*

Maxcy KF, Rosenau MJ, Last J, Wallace RB, editors. Maxcy-Rosenau- Last public health and preventive medicine. 14th ed. Stamford (CT): Appleton & Lange, 1998. *Although communicable diseases continue to be the main focus of this book, increased emphasis has been placed on environmental and behavioral factors that can influence health.*

Rosenstock L, Cullen M, editors. Textbook of clinical occupational and environmental medicine. Philadelphia: WB Saunders, 1994. *Complete coverage of the clinical aspects of occupational medicine.*

Sullivan JB Jr, Krieger GR, editors. Hazardous materials toxicology: clinical principles of environmental health. Baltimore: Williams & Wilkins, 1992. *A complete reference including epidemiology, principles of management and evaluation of toxic exposures, toxic hazards of specific industries and sites, and economic implications of medical and legal issues.*

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| **Poison Control Centers** | The regional poison control centers can act as valuable resources in providing information about the toxicity and health effects of hazardous exposures involved in poisonings. The main emergency number across the country is 1-800-222-1222, although some states have other contact numbers as well as a number for the hearing impaired. For more information, contact the American Association of Poison Control Centers at www.aapcc.org. |
| **Key Points** | • A variety of printed reference sources are available to the clinician, including books, journals, and Material Safety Data Sheets (MSDSs). |
| **Progress Check** | 11. Which of the following statements about MDSDs is incorrect?<br><br>A. The MSDS is a component of the right-to-know law.<br>B. MSDSs contain information on the chemical properties of the substance, handling precautions, known health effects, and conditions that might worsen with exposure.<br>C. Clinician may depend on the information on human health effects from MDSDs to come up with correct diagnoses.<br>D. Users of the chemicals must keep copies of MSDSs and make them available to workers, clinicians, and others.<br><br>*To review relevant content, see "Material Safety Data Sheet" in this section.* |

## Summary and Follow-Up

**Summary**

In each scenario, the clinician's pursuance of the exposure history led to discovery of toxic exposure for each of the three patients.

In each case, the diagnosis and treatment might have been inappropriate without an exposure history. The process required only a few minutes of the clinician's time; each history was focused as indicated by the patient's reported symptoms.

Using the exposure history in managing the patients' problems, as well as guiding the patients in appropriate preventive behaviors, is the practice of preventive medicine at its best.

**Follow-Up**

***Consultation***

Industrial hygienists, who are often employed by state health departments or industry, are a source of information to the clinician investigating a possible toxic exposure. Industrial hygiene is the discipline devoted to the recognition, evaluation, and control of workplace-related factors or stresses that may cause illness, impaired health or well-being, or significant discomfort and inefficiency among workers or community members.

Other medical specialists, such as clinicians specializing in occupational/environmental and general preventive medicine, can be helpful in assessing whether a significant exposure has occurred. Occupational health nurses, who often work at patients' work sites, also have expertise and experience that may be valuable to the clinician.

***Referral Resources***

The clinician is encouraged to build a network of occupational and environmental medical specialists for information, consultation, and referral.

The Association of Occupational and Environmental Clinics (AOEC) is a network of clinics that provide professional training, community education, exposure and risk assessment, clinical evaluations, and consultative services.

Pediatric Environmental Health Specialty Units (PEHSUs) have been developed to provide education and consultation for health professionals, public health professionals and others about the topic of children's environmental health. AOEC coordinates the activities for all of the PEHSUs.

Education and Resource Centers (ERCs) have been established in academic centers by the National Institute for Occupational Safety and Health (NIOSH) to educate professionals in occupational medicine topics. ERCs offer training courses in occupational and environmental medicine topics; continuing medical education credit is available.

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| **Key Points** | • It is important for clinicians to start taking an exposure history if they haven't done so.<br>• Many consultation and referral sources are available to help general practice physicians to play their roles in detecting, treating, and preventing diseases from environmental exposure. |

## What Instructions Should Be Given to Patients?

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| **Learning Objective** | Upon completion of this section, you will be able to<br>• explain to the patients why they need to provide all the detailed information about their past and current exposures from their jobs and homes |
| **Introduction** | It is important for health care provider to know what exposures to potentially hazardous materials your patients have had in their life. To do this your patients need to tell about workplace exposures, exposures at home, and others they may have had. |
| **Why Is an Exposure History Important** | Unless an exposure history is pursued by the clinician, the etiologic diagnosis might be missed, treatment therefore may be inappropriate, and exposure can continue. |
| **What to Ask Your Patients** | Be sure to ask information about all past jobs, and chemicals and other exposures they may have had in those jobs. Also share information about household and neighborhood exposures. |
| **Where Can Your Patients Get Information About Their Exposures?** | There are many sources of information about materials to which your patients have been exposed, or to which your patients are currently exposed. There are many Federal government agencies with such information including ATSDR, NIOSH, OSHA and EPA. Universities and poison control centers may also be able to supply information about potential health hazards. |
| **Key Points** | • Patients need to understand why an exposure history is important. |
| **Progress Check** | 12. When providing exposure history information, a patient should tell<br>A. their current job and home information only<br>B. their past and current jobs and home environments<br>C. everything asked in an exposure history form, including general information about their work and home, specific information regarding their past and current employment, hobbies, and home and surrounding environments<br>D. nothing.<br>*To review relevant content, see "Introduction" in this section.* |

## Where Can I Find More Information?

| | |
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| **For More Information** | Please refer to the following Web resources for more information on the adverse effects, the treatment and management of persons exposed to various hazardous substances. You may also contact ATSDR (see URLs provided below), your state and local health departments, and university medical centers.<br><br>Association of Occupational and Environmental Clinics<br><br>http://www.aoec.org<br><br>American College of Occupational and Environmental Medicine<br><br>http://www.acoem.org<br><br>American College of Medical Toxicologists<br><br>http://www.acmt.net<br><br>American College of Preventive Medicine<br><br>http://www.acpm.org<br><br>ATSDR Information Center:<br><br>http://www.atsdr.cdc.gov/icbkmark.html |
| **Other CSEMs** | *Case Studies in Environmental Medicine: Taking an Exposure History* is one monograph in a series. To view the *Taking an Exposure History* CSEM and other publications in this series, please go to<br><br>http://www.atsdr.cdc.gov/csem/ |

## Posttest Instructions

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| **Introduction** | ATSDR seeks feedback on this course so we can assess its usefulness and effectiveness. We ask you to complete the assessment questionnaire online for this purpose. In addition, if you complete the assessment and posttest online, you can receive continuing education credits as follows: |

| Accrediting Organization | Credits Offered |
|---|---|
| Accreditation Council for Continuing Medical Education (ACCME) | The Centers for Disease Control and Prevention (CDC) is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians. CDC designates this educational activity for a maximum of **1.5** *AMA PRA Category 1 Credit(s)*™. Physicians should only claim credit commensurate with the extent of their participation in the activity. |
| American Nurses Credentialing Center (ANCC), Commission on Accreditation | This activity for **1.5** contact hours is provided by the Centers for Disease Control and Prevention, which is accredited as a provider of continuing education in nursing by the American Nurses Credentialing Center's Commission on Accreditation. |
| National Commission for Health Education Credentialing, Inc. (NCHEC) | CDC is a designated provider of continuing education contact hours (CECH) in health education by the National Commission for Health Education Credentialing, Inc. The Centers for Disease Control and Prevention is a designated provider of continuing education contact hours (CECH) in health education by the National Commission for Health Education Credentialing, Inc. This program is a designated event for the Certified Health Education Specialist (CHES) to receive **1.5** Category I contact hours in health education, CDC provider number GA0082. |
| International Association for Continuing Education and Training (IACET) | The Centers for Disease Control and Prevention (CDC) has been reviewed and approved as an Authorized Provider by the International Association for Continuing Education and Training (IACET), Suite 800, McLean, VA 22102. CDC will award **0.15** of CEU's to participants who successfully complete this program. |

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| ***Disclaimer*** | In compliance with continuing education requirements, all presenters must disclose any financial or other relationships with the manufacturers of commercial products, suppliers of commercial services, or commercial supporters as well as any use of unlabeled product(s) or product(s) under investigational use.<br><br>CDC/ATSDR, our planners, and the presenters for this seminar do not have financial or other relationships with the manufacturers of commercial products, suppliers of commercial services or commercial supporters. This presentation does not involve the unlabeled use of a product or product under investigational use. |

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| **Instructions** | To complete the assessment and posttest, go to http://www2.cdc.gov/atsdrce and follow the instructions on that page. You can immediately print your continuing education certificate from your personal transcript online. No fees are charged. |

**Posttest**

1. Which of the following statements regarding diagnosis of environmental diseases are true?

   A. Extensive knowledge of toxicology is necessary.
   B. Signs and symptoms, onset and temporal pattern, physical examination, and laboratory results are important in making a diagnosis.
   C. Extensive laboratory and environmental testing is always necessary in making a diagnosis.
   D. Signs and symptoms of environmental diseases are often specific and never similar to common maladies.

2. Goals of an exposure history are

   A. identifying past and present toxic exposures
   B. ending the patient's exposure to toxins
   C. proper treatment of the patient's illness
   D. all of the above.

3. Angina pectoris can be exacerbated by which of the following?

   A. ethylene glycol
   B. methylene chloride
   C. carbon monoxide
   D. asbestos

4. Which of the following statements is NOT true?

   A. Complete evaluation of the form is necessary in every clinical situation.
   B. The completed form can be used to evaluate the patient's present complaint and also as a database for future use.
   C. The completed form may alert the clinician to a significant past exposure.
   D. The forms can be self-administered.

5. All of the following statements are true except?

   A. Hobbies can be sources of toxic exposure to all household members.
   B. Labels required by law on household products are adequate in identifying product constituents.
   C. People often do not know the names of the toxicant to which they are routinely exposed.
   D. Family pets' health and behavior can give clues to toxic exposure in the home.

6. Sources of information that may be helpful to the clinician in treating and managing an exposed patient include the following:

   A. MSDSs
   B. Poison control centers
   C. AOECs
   D. all of the above.

7. Sources of consultation in evaluating a potentially exposed patient include the following

   A. industrial hygienists
   B. toxicologists
   C. occupational specialists
   D. all of the above.

8. Which of the following statements regarding the exposure history process are true?

   A. Exploring the temporal aspects of signs and symptoms can provide clues to the source of exposure.
   B. Knowing job titles is necessary when attempting to identify toxic exposures.
   C. Employment handbooks are the best printed source to detail information on toxic exposures.
   D. none of the above.

| **Relevant Content** | To review content relevant to the posttest questions, see: |
|---|---|
| **Question** | **Location of Relevant Content** |
| 1 | What role can primary care clinicians play in detecting, treating, and preventing disease resulting from toxic exposures? |
| 2 | What is the purpose of taking an exposure history? |
| 3 | What is included in the exposure survey (Part 1) of an exposure history form? |
| 4 | What role can primary care clinicians play in detecting, treating, and preventing disease resulting from toxic exposures? |
| 5 | What are other toxicants in the home and environment? |
| 6 | Summary and Follow-up |
| 7 | Summary and Follow-up |
| 8 | What is included in the work history (Part 2) of an exposure history form? |

## Literature Cited

1. Agency for Toxic Substances and Disease Registry (1997). "Toxicological Profile for Trichloroethylene." U.S. Department of Health & Human Services, Public Health Service. Atlanta.
2. Amdur MO, D. J., Klaassen CD, editors. (1991). "Casarett and Doull's Toxicology: the basic science of poisons." **4th ed. New York: Pergamon Press;**.
3. Anonymous (1993). "Obtaining an exposure history. Agency for Toxic Substances and Disease Registry. United States department of Health and Human Services, Public Health Service, Atlanta, Georgia." American Family Physician **48** (3): 483-91.
4. Becker, C. E. (1982). "Key elements of the occupational history for the general physician." Western Journal of Medicine **137** (6): 581-2.
5. Bresnitz, E. A., K. M. Rest, *et al.* (1985). "Clinical industrial toxicology. An approach to information retrieval.[erratum appears in Ann Intern Med 1986 Feb;104 (2):290]." Annals of Internal Medicine **103** (6 ( Pt 1)): 967-72.
6. Dhala, A., K. Pinsker, *et al.* (2006). "Respiratory health consequences of environmental tobacco smoke." Clinics in Occupational & Environmental Medicine **5** (1): 139-56.
7. Frank AL (2000). "Occupational and Environmental Medicine: Approach to the patient with an occupational or nvironmental illness." Primary Care; Clinics in Office Practice **27** (4).
8. Goldman, R. H. and J. M. Peters (1981). "The occupational and environmental health history." JAMA **246** (24): 2831-6.
9. Kilpatrick, N., H. Frumkin, *et al.* (2002). "The environmental history in pediatric practice: a study of pediatricians' attitudes, beliefs, and practices." Environmental Health Perspectives **110** (8): 823-7.
10. Levy BS and Wegman DH, e. (2000). "Occupational health: Recognizing and preventing work-related disease and injury." 6th ed. Philadelphia: Lippincott, Williams and Wilkins, Brown & Company.
11. Marshall, L., E. Weir, *et al.* (2002). "Identifying and managing adverse environmental health effects: 1. Taking an exposure history.[see comment]." CMAJ Canadian Medical Association Journal **166** (8): 1049-55.
12. McCurdy, S. A., L. A. Morrin, *et al.* (1998). "Occupational history collection by third-year medical students during internal medicine and surgery inpatient clerkships.[see comment]." Journal of Occupational & Environmental Medicine **40** (8): 680-4.
13. Merritt, E. F. (1999). "Human health and the environment: are physician educators lagging behind?" JAMA **281** (17): 1661.
14. Pope AM and Rall DP, e. (1995). "Environmental medince: Integrating a missing element into medical education." National Academy Press, Washington, D.C.
15. Rom, W., editor. (1998). "Environmental and occupational medicine. ." 3rd ed. Boston: Lippincott-Raven Publishers, Philadelphia.
16. Thompson, J. N., C. A. Brodkin, *et al.* (2000). "Use of a questionnaire to improve occupational and environmental history taking in primary care physicians." Journal of Occupational & Environmental Medicine **42** (12): 1188-94.
17. Tomaszewski, C. (1999). "Carbon monoxide poisoning. Early awareness and intervention can save lives." Postgraduate Medicine **105** (1): 39-40.
18. US Environmental Protection Agency (1985). "Health assessment document for trichloroethylene. Final Report.
19. ." Washington: US Environmental Protection Agency. NTIS Report No. PB/85-249696.
20. US Environmental Protection Agency (1986). "Pesticide Fact Book." A-107/86-003, US Environmental Protection Agency, Washington, D.C.

21. US Environmental Protection Agency and US Consumer Product Safety Commission (1995). "The inside story: a guide to indoor air quality." Washington: US Environmental Protection Agency. Report No.: EPA 402-K-93-007. **Available from url: http://www.epa.gov/iaq/pubs/insidest.html.**
22. Wigle D (2000). "Child health and the environment." Patient Care Canada **11**: 54-62.

## Appendix 1: Exposure History Form

**Part 1. Exposure Survey** Name: _____Date:_____

Please circle the appropriate answer. Birth date: _____Sex (circle one): Male Female

| | |
|---|---|
| 1. Are you currently exposed to any of the following? | |
| metals | no yes |
| dust or fibers | no yes |
| chemicals | no yes |
| fumes | no yes |
| radiation | no yes |
| loud noise, vibration, extreme heat or cold | no yes |
| biologic agents | no yes |
| 2. Have you been exposed to any of the above in the past? | no yes |
| 3. Do any household members have contact with metals, dust, fibers, chemicals, fumes, radiation, or biologic agents? | no yes |

If you answered yes to any of the items above, describe your exposure in detail—how you were exposed; to what you were exposed, to what extent (how much) you were exposed if you know. If you need more space, please use a separate sheet of paper.

| | | | |
|---|---|---|---|
| 4. | Do you know the names of the metals, dusts, fibers, chemicals, fumes, or radiation that you are/were exposed to? [If yes, list them below.] | no | yes |
| 5. | Do you get the material on your skin or clothing? | no | yes |
| 6. | Are your work clothes laundered at home? | no | yes |
| 7. | Do you shower at work? | no | yes |
| 8. | Can you smell the chemical or material you are working with? | no | yes |
| 9. | Do you use protective equipment such as gloves, masks, respirator, hearing protectors? [If yes, list the protective equipment used.] | no | yes |
| 10. | Have you been advised to use protective equipment? | no | yes |
| 11. | Have you been instructed in the use of protective equipment? | no | yes |
| 12. | Do you wash your hands with solvents? | no | yes |
| 13. | Do you smoke at the workplace? | no | yes |
| | at home? | no | yes |
| 14. | Are you exposed to secondhand tobacco smoke at the workplace? | no | yes |
| | at home? | no | yes |
| 15. | Do you eat at the workplace? | no | yes |
| 16. | Do you know of any coworkers experiencing similar or unusual symptoms? | no | yes |
| 17. | Are family members experiencing similar or un-usual symptoms? | no | yes |
| 18. | Has there been a change in the health or behavior of family pets? | no | yes |
| 19. | Do your symptoms seem to be aggravated by a specific activity? | no | yes |
| 20. | Do your symptoms get either worse or better at work? | no | yes |
| | at home? | no | yes |
| | on weekends? | no | yes |
| | on vacation? | no | yes |
| 21. | Has anything about your job changed in recent months (such as duties, procedures, overtime)? | no | yes |
| 22. | Do you use any traditional or alternative medicines? | no | yes |
| 23. | Have you or your child ever eaten on-food items, such as paint, plaster, dirt, clay? | no | yes |
| If you answered yes to any of the questions, please explain. | | | |
| If you answered *yes* to any of the questions, please explain. | | | |

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**Part 2. Work History** Name: _____

**A. Occupational Profile** Birth date: _____ Sex: Male Female

The following questions refer to your current or most recent job:

Job title: _____Describe this job: _____

Type of industry:_____

Name of employer: _____

Date job began: _____

Are you still working in this job? Yes No

If no, when did this job end? _____

Fill in the table below listing all jobs you have worked including short-term, seasonal, part-time employment, and military service. Begin with you most recent job. Use additional paper if necessary.

| Dates of Employment | Job Title and Description of Work | Exposures* | Protective Equipment |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

*List the chemicals, dusts, fibers, fumes, radiation, biologic agents (*i.e.*, molds or viruses) and physical agents (*i.e.*, extreme heat, cold, vibration, noise) that you were exposed to at this job.

Have you ever worked at a job or hobby in which you came in contact with any of the following by breathing, touching, or ingesting (swallowing)? If *yes*, please check the circle beside the name.

| | | | |
|---|---|---|---|
| O Acids | O Chloroprene | O Methylene chloride | O Styrene |
| O Alcohols (industrial) | O Chromates | O Nickel | O Talc |
| O Alkalies | O Coal dust | O PBBs | O Toluene |
| O Ammonia | O Dichlorobenzene | O PCBs | O TDI or MDI |
| O Arsenic | O Ethylene dibromide | O Perchloroethylene | O Trichloroethylene |
| O Asbestos | O Ethylene dichloride | O Pesticides | O Trinitrotoluene |
| O Benzene | O Fiberglass | O Phenol | O Vinyl chloride |
| O Beryllium | O Halothane | O Phosgene | O Welding fumes |
| O Cadmium | O Isocyanates | O Radiation | O X-rays |
| O Carbon tetrachloride | O Ketones | O Rock dust | O Other (specify) |
| O Chlorinated naphthalenes | O Lead | O Silica powder | |
| O Chloroform | O Mercury | O Solvents | |

### B. Occupational Exposure Inventory

Please circle the appropriate answer.

| | |
|---|---|
| 1. Have you ever been off work for more than 1 day because of an illness related to work? | no yes |
| 2. Have you ever been advised to change jobs or work assignments because of any health problems or injuries? | no yes |
| 3. Has your work routine changed recently? | no yes |
| 4. Is there poor ventilation in your workplace? | no yes |

---

### Part 3. Environmental History

Please circle the appropriate answer.

| | |
|---|---|
| 1. Do you live next to or near an industrial plant, commercial business, dump site, or nonresidential property? | no yes |
| 2. Which of the following do you have in your home? *Please circle those that apply.* | |
| Air conditioner / Air purifier / Central heating (gas or oil?) / Gas stove | |
| Electric stove / Fireplace / Wood / Humidifier | |
| 3. Have you recently acquired new furniture or carpet, refinished furniture, or remodeled your home? | no yes |
| 4. Have you weatherized your home recently? | no yes |
| 5. Are pesticides or herbicides (bug or weed killers; flea and tick sprays, collars, powders, or shampoos) used in your home or garden, or on pets? | no yes |
| 6. Do you (or any household member) have a hobby or craft? | no yes |
| 7. Do you work on your car? | no yes |
| 8. Have you ever changed your residence because of a health problem? | no yes |
| 9. Does your drinking water come from a private well, city water supply, or grocery store? | no yes |
| 10. Approximately what year was your home built?_____ | |

If you answered *yes* to any of the questions, please explain.

* *Developed by ATSDR in cooperation with NIOSH, 1992*

## Appendix 2: Sample MSDS

CARBON DISULFIDE

MSDS Number: C0957 — *Effective Date: 11/17/99*

### 1. Product Identification

Synonyms: Carbon bisulfide CAS No.: 75-15-0 Molecular Weight: 76.1 Chemical Formula: CS2

Product Codes: J.T. Baker: 9172, E350

Mallinckrodt: 8831

### 2. Composition/Information on Ingredients

Ingredient CAS No Percent Hazardous

Carbon Disulfide 75-15-0 90 - 100% Yes

### 3. Hazards Identification

Emergency Overview: Danger! Extremely flammable liquid and vapor. Vapor may cause flash fire. May be fatal if swallowed or inhaled. Harmful if absorbed through skin. Affects the central and peripheral nervous systems. A developmental and reproductive hazard. Affects cardiovascular system, liver and kidneys.

J.T. Baker SAF-T-DATA (tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)

Flammability Rating: 4 - Extreme (Flammable)

Reactivity Rating: 2 - Moderate

Contact Rating: 3 - Severe (Life)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation: Vapors cause irritation to the respiratory tract, followed by symptoms of headache, dizziness, fatigue, garlic breath, nausea, vomiting, and abdominal pains. Affects the central nervous system and peripheral nervous system. Overexposure may produce

hallucinations, narcosis, unconsciousness, convulsions, and even death.

Ingestion: TOXIC! Symptoms parallel those of inhalation. May cause permanent disabilities described below in Chronic Exposure.

Skin Contact: May produce reddening and burning, cracking and peeling. Contact with liquid for several minutes may result in a second-degree burn. Skin absorption can occur even in the presence of vapors, with toxic effects paralleling inhalation.

Eye Contact: Vapors cause eye irritation. Splashes cause severe irritation, possible corneal burns and eye damage.

Chronic Exposure: Kidney and liver damage, reproductive disorders, central and peripheral nervous system damage, vision problems, psychosis, and cardiovascular effects are associated with chronic exposure to Carbon Disulfide.

Aggravation of Pre-existing Conditions: Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance. Affects the developing fetus.

## 4. First Aid Measures

FOLLOWING ANY ROUTE OF EXPOSURE GET MEDICAL ATTENTION IMMEDIATELY.

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion: Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact: Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact: Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician: Since effects may be delayed, keep victim under observation. The iodide-azide test is useful in detecting degree of exposure and hyposusceptiblility of exposed workers. I.V. urea 0.5 to 1.5 g/kg is recommended to inactivate free carbon disulfide in the blood. Vitamin B6 in large doses is recommended. Obtain CBC, EKG, urinalysis, and electrolyte balance.

## 5. Fire Fighting Measures

Fire: Flash point: -30C (-22F) CC Autoignition temperature: 90C (194F) Flammable limits in air % by volume: lel: 1.3; uel: 50 Extremely Flammable Liquid and Vapor. Contact with strong oxidizers may cause fire. May ignite on contact with hot surfaces such as light bulbs,

steam pipes, or engine exhaust pipes.

Explosion: Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Sealed containers may rupture when heated. Sensitive to static discharge.

Fire Extinguishing Media: Dry chemical, foam or carbon dioxide. Fluoroprotein and protein foams are recommended over other types for carbon disulfide. Water spray may be used to keep fire exposed containers cool. Do not allow water runoff to enter sewers or waterways.

Special Information: In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. This highly flammable liquid must be kept from sparks, open flame, hot surfaces, and all sources of heat and ignition. Flush area with water spray to cool containers and prevent reignition.

### 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (*e.g.*, vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802. J. T. Baker SOLUSORB (R) solvent adsorbent is recommended for spills of this product.

### 7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Prepare safe grounding routes for lightning strikes in storage area. Electrical installations and heating facilities must be prohibited in or near storage areas. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

### 8. Exposure Controls/Personal Protection

Airborne Exposure Limits: OSHA Z-2 TWA, 8 hour 20 ppm; 30 ppm Ceiling; 100 ppm Peak Concentration; Maximum Duration 30 minutes ACGIH Threshold Limit Value (TLV): 10 ppm (TWA) (skin)

Ventilation System: A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source,

preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved): If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to 10 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator.

WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection: Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection: Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

## 9. Physical and Chemical Properties

Appearance: Clear, colorless liquid.

Odor: Nearly odorless when pure, but most material has a strong garlic-type odor.

Solubility: 0.2 gm/100 ml water. Density: 1.26

pH: No information found. % Volatiles by volume @ 21C (70F): 100

Boiling Point: 46C (115F) Melting Point: -100C (-148F)

Vapor Density (Air=1): 2.6 Vapor Pressure (mm Hg): 300 @ 20C (68F)

Evaporation Rate (BuAc=1): 22.6

## 10. Stability and Reactivity

Stability: Stable at room temperature in sealed containers. Heat and sunlight can contribute to instability. Containers may burst when heated.

Hazardous Decomposition Products: Burning may produce carbon monoxide, carbon dioxide, sulfur oxides.

Hazardous Polymerization: Will not occur.

Incompatibilities: Contact with strong oxidizers and chemically active metals (such as Potassium, Zinc), chlorine, nitrogen oxides, azides, and organic amines may cause fire and

explosions.

Conditions to Avoid: Heat, flames, ignition sources and incompatibles.

## 11. Toxicological Information

Toxicological Data: Inhalation rat LC50: 25 gm/m3/2H. Investigated as a mutagen, reproductive effector.

Reproductive Toxicity: Carbon disulfide is a known human reproductive hazard. Menstrual disorders, spontaneous abortions and premature births are reported in cases of chronic exposure.

----------\Cancer Lists\----------

---NTP Carcinogen---

Ingredient Known Anticipated IARC Category

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Carbon Disulfide (75-15-0) No No None

## 12. Ecological Information

Environmental Fate: When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life of less than 1 day. This material has an experimentally-determined bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.

Environmental Toxicity: No information found.

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

## 14. Transport Information

Domestic (Land, D.O.T.) International (Water, I.M.O.)

Proper Shipping Name: CARBON DISULFIDE Proper Shipping Name: CARBON DISULPHIDE

Hazard Class: 3, 6.1 Hazard Class: 3.1, 6.1

UN/NA: UN1131 UN/NA: UN1131

Packing Group: I Packing Group: I

Information reported for product/size: 2.5L Information reported for product/size: 2.5L

International (Air, I.C.A.O.)

Proper Shipping Name: CARBON DISULPHIDE

Hazard Class: 3.1, 6.1

UN/NA: UN1131

Packing Group: I

Information reported for product/size: 2.5L

## 15. Regulatory Information

---------\Chemical Inventory Status - Part 1\----------

Ingredient TSCA EC Japan Australia

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Carbon Disulfide (75-15-0) Yes Yes Yes Yes

---------\Chemical Inventory Status - Part 2\----------

--Canada--

Ingredient Korea DSL NDSL Phil.

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Carbon Disulfide (75-15-0) Yes Yes No Yes

--------\Federal, State & International Regulations - Part 1\----------

-SARA 302- ------SARA 313--

Ingredient RQ TPQ List Chemical Catg.

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Carbon Disulfide (75-15-0) 100 10000 Yes No

--------\Federal, State & International Regulations - Part 2\----------

-RCRA- -TSCA

Ingredient CERCLA 261.33 8 (d)

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Carbon Disulfide (75-15-0) 100 P022 Yes

Chemical Weapons Convention: No TSCA 12 (b): No CDTA: No

SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No

Reactivity: No (Pure / Liquid)

WARNING: THIS PRODUCT CONTAINS A CHEMICAL (S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 3WE

Poison Schedule: S6

WHMIS: This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 4 Reactivity: 0

Label Hazard Warning: DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE CENTRAL AND PERIPHERAL NERVOUS SYSTEMS. A DEVELOPMENTAL AND REPRODUCTIVE HAZARD. AFFECTS CARDIOVASCULAR SYSTEM, LIVER AND KIDNEYS.

Label Precautions: Keep away from heat, sparks and flame. Do not breathe vapor. Keep container closed. Do not get in eyes, on skin, or on clothing. Use only with adequate ventilation. Wash thoroughly after handling.

Label First Aid: If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If

not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use: Laboratory Reagent.

Revision Information: No changes.

Disclaimer:

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