

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

RESIDENTIAL ENVIRONMENTAL HAZARDS: *A Guide For Homeowners, Homebuyers, Landlords and Tenants* 2011

This guide was originally developed by M. B. Gilbert Associates, under contract with the California Department of Real Estate in cooperation with the California Department of Health Services. The 2005 edition was prepared by the California Department of Toxic Substances Control, in cooperation with the California Air Resources Board and the California Department of Health Services, and meets all State and Federal guidelines and lead disclosure requirements pursuant to the Residential Lead-Based Paint Hazard Reduction Act of 1992. The 2005 edition incorporates the Federal "Protect Your Family from Lead" pamphlet. The 2011 update was developed by the California Department of Toxic Substances Control. This booklet is offered for information purposes only, not as a reflection of the position of the administration of the State of California.

Table of Contents

INTRODUCTION	3
CHAPTER I ASBESTOS	3
CHAPTER II CARBON MONOXIDE	10
CHAPTER III FORMALDEHYDE	13
CHAPTER IV HAZARDOUS WASTE	17
CHAPTER V HOUSEHOLD HAZARDOUS WASTE	21
CHAPTER VI LEAD	24
CHAPTER VII MOLD	31
CHAPTER VIII RADON	36
APPENDIX A LIST OF FEDERAL AND STATE AGENCIES	42
APPENDIX B GLOSSARY	46

Introduction

The California Departments of Real Estate and Health Services originally prepared this booklet in response to the California legislative mandate (Chapter 969, Statutes of 1989, AB 983, Bane) to inform the homeowner and prospective homeowner about environmental hazards located on and affecting residential property.

The 2005 edition was prepared by the California Department of Toxic Substances Control, in cooperation with the California Air Resources Board and the California Department of Health Services' Childhood Lead Poisoning Prevention Program, Radon Program, and Division of Drinking Water and Environmental Management, in response to a 1994 legislative mandate (Chapter 264, Statutes of 1994, AB 2753, Sher). The 1994 legislation also requires this booklet to consolidate the California disclosure requirements (Ch. 969, Statutes of 1989) and the federal disclosure requirements (The Residential Lead-Based Paint Hazard Reduction Act of 1992).

The information contained in this booklet is an overview of some environmental hazards which may be found on or in residential property and which may affect residential real estate. Since this booklet is not meant to be all inclusive, it should be used only for general guidance. Although law requires the disclosure of known hazards, an environmental survey may be conducted to obtain further information. Homeowners, tenants, and prospective homeowners may wish to obtain other literature for additional information on hazards of concern.

In California, sellers are required to disclose the presence of any known environmental hazard. A statement that the homeowner is unaware of environmental hazards is not a guarantee that the property is free of such hazards. It is in the homeowner's and prospective homeowner's interest to know what hazards are common, where they are found, and how they might be mitigated. This booklet will provide homeowners and prospective homeowners with the information and additional resources needed to make an informed decision about environmental hazards that may be present on a property.

Because of the contribution of household hazardous wastes to the problem of hazardous waste disposal, a section on proper storage and disposal of household hazardous products is included. In discussing health impacts of hazardous substances, lifetime exposure to low levels is emphasized because the resident is more likely to encounter this type of exposure than exposure to high levels of hazards for a short time. Sources of additional information and a list of government agencies are provided for further information.

Pursuant to AB 983, if this environmental hazards booklet is made available to homeowners or prospective homeowners, real estate licensees and home sellers are not required to provide additional information on such hazards. However, delivery of this publication to homeowners or prospective homeowners does not relieve home sellers

and real estate licensees of the responsibility to disclose the existence of environmental hazards when such hazards are known to them.

The material is presented with the understanding that the publisher is not engaged in offering legal or other professional advice. If legal or other expert assistance is required, the services of a skilled professional should be obtained.

CHAPTER I ASBESTOS

What is Asbestos?

Asbestos is the name given to a number of naturally occurring fibrous silicate minerals that have been mined for their useful properties such as thermal insulation, chemical and thermal stability, and high tensile strength. The three common types of asbestos are chrysotile, amosite, and crocidolite. Chrysotile, also known as white asbestos and a member of the serpentine mineral group, is the most common. Asbestos can only be identified under a microscope.

Where is asbestos found in the home?

Asbestos has been used in many products found in the home that provide insulation, strength, and fire protection. In 1989, the U.S. Environmental Protection Agency (U.S. EPA) announced a phased ban of asbestos products to be completed by 1996. However, in 1991, the U.S. Fifth Circuit Court of Appeals overturned and remanded the asbestos ban and phase-out rule to EPA. Today, most asbestos products can still be legally manufactured, although production of asbestos containing materials has decreased dramatically since the late 1970s. The most common items in the home that may contain asbestos are:

- # Vinyl flooring
- # Duct wrapping on heating and air conditioning systems
- # Insulation on hot water pipes and boilers
- # Some roofing shingles, and siding
- # Vermiculite attic insulation
- # Ceiling and wall insulation
- # Sheet rock taping compounds and some ceiling materials

Asbestos that has been sprayed on ceilings often has a spongy, "cottage cheese" appearance with irregular soft surfaces. Asbestos troweled on walls has a textured, firm appearance. Vermiculite attic insulation, found both in the attic between trusses and in-between walls, also has the potential to contain asbestos. Vermiculite attic insulation is a pebble-like, pour-in product and is usually light-brown or gold in color.

Manufacturers can provide information on the asbestos content of home products. A certified asbestos consultant can be hired to test building material and determine whether or not asbestos is present and to give advice about how to take care of it safely. Current asbestos bulk testing methods may be insufficient to determine the presence of asbestos in vermiculite attic insulation. For more information on vermiculite, see U.S. EPA's Protect Your Family from Asbestos-Contaminated Vermiculite at www.epa.gov/asbestos/pubs/verm_questions.html.

How is asbestos harmful?

Intact or sealed (painted or taped over) asbestos is not harmful unless it becomes damaged and friable. Friable means the material can be easily crushed or pulverized to a powder by hand pressure. Friable materials have a higher potential to release fibers. Asbestos fibers that are released into the air and inhaled can accumulate in the lungs and pose a health risk. This risk can be divided into two general categories: risk of asbestosis (lung scarring); and increased risk of cancer.

The U.S. EPA classifies asbestos as a known human carcinogen. If asbestos fibers are inhaled, the chance of contracting lung cancer or mesothelioma (cancer of the lining of the chest or abdomen) increases. The more asbestos is inhaled, the greater risk of developing cancer. Smokers who are exposed to high levels of asbestos have a much greater risk of developing lung cancer than nonsmokers exposed to the same level. Symptoms of cancer may not develop until 10-40 years after the first exposure to asbestos.

Is there a safe level of asbestos?

There is no safe level of asbestos exposure. The more asbestos fibers you inhale, the greater your risk of developing lung cancer and asbestos-related disease. Exposure to asbestos should always be avoided.

How can asbestos content in materials be determined?

When you suspect asbestos is present in building materials, it is important to have the materials tested by a qualified laboratory. Visual inspection alone is not enough to identify the presence of asbestos. It is recommended that you contact a certified asbestos consultant to take samples of potential asbestos containing materials and have them tested by a qualified laboratory. A list of asbestos consultants who have been certified by the California Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA) for evaluating building materials and recommending a course of action may be obtained on the Internet at www.dir.ca.gov/Databases/doshacru/acruList.asp or by calling 510-286-7362.

How should the homeowner repair or remove asbestos?

Repair or removal of asbestos by the homeowner may be unwise if the damage is severe, since it may result in unnecessary exposure to airborne fibers. In cases where planned remodeling projects are expected to damage asbestos-containing materials, it is wise to hire a qualified contractor to remove the material. The homeowner should use the following guidelines in choosing a qualified contractor:

- # Check to see if the contractor is licensed by the California Contractors State License Board and registered with the California Department of Industrial

Relations, Division of Occupational Safety and Health (Cal/OSHA) for doing asbestos work.

- # Be aware that some contractors may remove material incorrectly and still charge a substantial fee.
- # Require references from the contractor and check them to see if the contractor's work is satisfactory.
- # Require the contractor to specify his safety procedures in writing.

The homeowner can expect to pay three times as much for a small removal job than a large one as it is expensive for a contractor to set up all the necessary safety equipment. You should consider hiring a certified asbestos consultant to review safety procedures and oversee the performance of the contractor.

Does the law require asbestos mitigation?

Asbestos mitigation is at the discretion of the homeowner. Even if material contains asbestos, the homeowner may choose to leave it alone or, if necessary, repair it. If the home owner chooses to do his or her own repairs, the home owner must comply with the law. The free Department of Toxic Substances Control fact sheet "Managing Asbestos Waste" is available on the DTSC Web site at www.dtsc.ca.gov/PublicationsForms/upload/OAD_FS_Asbestos1.pdf

What about naturally occurring asbestos that is found near the home?

Naturally Occurring Asbestos (NOA) includes six regulated naturally occurring minerals (actinolite, amosite, anthophyllite, chrysotile, crocidolite, and tremolite) and is commonly found in California within serpentine and other ultramafic rocks and soils of the Coastal Ranges, Klamath Mountains, and the Sierra Nevada Mountains. The California Geological Survey has produced a map that identifies areas more likely to contain NOA in California. The map may be found online at www.consrv.ca.gov/cgs/minerals/hazardous_minerals/asbestos/index.htm.

Asbestos fibers may be released into the air as a result of activities which disturb NOA-containing rock or soils. Development construction activities in areas that contain NOA may release asbestos. Also, driving on roads or driveways surfaced with asbestos containing gravel, such as serpentine, may release asbestos. The California Air Resources Board (ARB) has established Asbestos Airborne Toxic Control Measures (ATCMs) to regulate the surfacing of roads with asbestos-containing gravels and construction and grading activities in areas potentially containing asbestos. For more information about naturally occurring asbestos, go to www.arb.ca.gov/toxics/abestos/abestos.htm.

Hotlines:

For information on the identification and abatement of asbestos hazards in the home, and other information about asbestos visit the U.S. EPA Asbestos Web site at

www.epa.gov/asbestos.

For technical assistance and information about:

- # Toxic Substances Control Act (TSCA);
- # Regulations and programs administered under TSCA, including asbestos, lead-based paint, and PCB's; and
- # EPA's 33/60 voluntary pollution prevention program;

Contact the Toxic Substances Control Act Assistance Information Service (T.A.I.S.), Washington, D.C. at:

Telephone: (202) 554-1404

Fax: (202) 554-560

E-mail: tsca-hotline@epa.gov

Publications:

Indoor Air Quality Infosheet - Asbestos

This free publication is available from:

American Lung Association
Environmental Health Department

909 12th Street

Sacramento, CA 95814

Telephone: (800) LUNG-USA [(800) 586-4872]

***The Inside Story - A Guide to Indoor Air Quality
Asbestos in Your Home***

These free publications are available from:

U.S. EPA Indoor Air Quality Information Clearinghouse

P.O. Box 37133

Washington, D.C. 20013-7133

Telephone: (800) 438-4318

FAX: (202) 484-1510

E-mail: iaqinfo@aol.com

Web: www.epa.gov/iaq

Asbestos in the Home and Workplace

This list is available on the Internet from:

California Department of Health Services

Indoor Air Quality Program

http://www.cdph.ca.gov/programs/IAQ/Documents/IAQ_Asbestos_2000-03.pdf

List of Certified Asbestos Consultants

This list is available on the Internet or by mail for \$8.00 from:

California Department of Industrial Relations
Division of Occupational Safety and Health (Cal/OSHA)
Asbestos Consultant Certification Unit
2211 Park Towne Circle, Suite 1
Sacramento, CA 95825
Telephone: (916) 574-2993
Web: www.dir.ca.gov

List of Asbestos Abatement Contractors

This list is available for \$25.00 from:

California Department of Industrial Relations
Division of Occupational Safety and Health (Cal/OSHA)
Asbestos Contractor Registration Unit
455 Golden Gate Avenue, 10th Floor
San Francisco, CA 94102
Telephone: (415) 703-5190
Web: www.dir.ca.gov

What You Should Know Before You Hire a Contractor

This free publication is available from:

California Contractors State License Board
9835 Goethe Road
P.O. Box 26000
Sacramento, CA 95827
Telephone: (800) 321-2752 (To receive the publication, leave your name and address on message phone.)

Note: Telephone numbers and prices were correct at the date of publication of this booklet, but are subject to change.

CHAPTER II CARBON MONOXIDE

What is carbon monoxide?

Carbon Monoxide (CO) is an odorless, colorless and tasteless gas. It is highly toxic to humans and animals in higher quantities.

Because it is impossible to see, taste or smell, breathing CO can incapacitate or kill you before you are aware it is present in your home. At lower concentrations, CO may produce flu-like symptoms, including headache, dizziness, disorientation, nausea and fatigue.

What are the sources of carbon monoxide in the home?

CO is the result of incomplete combustion of carbon fuels and is produced from both man-made and natural sources. Typical sources of CO in the home are:

- # Unvented kerosene and gas space heaters
- # Gas water heaters
- # Improperly adjusted or maintained furnaces or boilers
- # Wood stoves and fireplaces
- # Gas stoves and ovens
- # Gasoline powered equipment, such as generators
- # Automobile exhaust
- # Tobacco smoke

How is carbon monoxide harmful?

Following inhalation, CO combines with hemoglobin in the blood producing carboxyhemoglobin, which is ineffective in delivering oxygen to the body tissues. Carbon monoxide binds to other molecules such as myoglobin and mitochondrial cytochrome oxidase and may cause significant damage to the heart and central nervous system.

At low concentrations, CO exposure may result in fatigue in healthy individuals and chest pain in people with heart disease. At higher concentrations, CO may result in headache, nausea, dizziness, confusion, impaired vision, angina and reduced brain function, depending upon the concentration in air and length of exposure. Exposure to very high concentrations of CO can be fatal.

Breathing high levels of CO during pregnancy may result in miscarriage. Breathing moderate levels of CO during pregnancy can result in slower than normal mental development of your child. In animal studies, exposure to CO during pregnancy had

effects on birth weight, the heart, the central nervous system and development. Children with asthma may be more susceptible to respiratory effects following exposure to CO.

What levels of carbon monoxide are found in the home?

Typical levels in homes with no gas appliances range from 0.5 to 5 parts per million (ppm). Levels measured near properly adjusted gas appliances were between 5 and 15 ppm, while levels near poorly adjusted appliances can be 30 ppm or higher.

Is there a safe level of carbon monoxide?

No standards for CO have been adopted for indoor air. The National Ambient Air Quality Standards for outdoor air are 9 ppm for eight hours and 35 ppm for one hour. The State of California Air Resources Board (ARB) air quality standards for CO are 9 ppm for eight hours and 20 ppm for one hour. The State of California, Office of Environmental Health Hazard Assessment (OEHHA) established an acute, one hour exposure level of 23,000 micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$) or 20 ppm for CO. This exposure level was based on heart toxicity.

Can carbon monoxide be detected and measured?

California Senate Bill 183 (SB 183) will require owners of single family homes that have a fossil-fuel burning appliance, fireplace or attached garage to install a CO alarm(s) by July 1, 2011. CO detectors trigger an alarm based on accumulation of CO over time or continuous detection of CO.

What can be done to reduce exposure to carbon monoxide?

Always make sure that gas appliances are maintained and properly installed. Here are some common tips to reduce potential CO levels in your home:

- # Make sure appliances that burn natural gas, kerosene or other fuels are properly installed and vented.
- # Have all appliances maintained on a regular basis.
- # Always follow the manufacturer's recommendations and instructions for installation of these devices.
- # Do not use portable gas heaters in enclosed indoor settings.
- # Do not let your car idle for long periods of time inside the garage.
- # Install and use an exhaust fan vented to the outside over gas stoves.
- # Make sure the flue is open when using your fireplace.
- # Use properly sized wood stoves certified to meet emission standards.
- # Most importantly, install carbon monoxide detectors throughout the home.

Links to Additional Information on Carbon Monoxide:

U.S. EPA, An Introduction to Indoor Air Quality (IAQ), Basic Information on Pollutants and Sources of Indoor Air Pollution, Carbon Monoxide,

www.epa.gov/iaq/co.html

OEHHA, Impacts of Criteria Air Pollutants on the Respiratory Health of Children

www.oehha.ca.gov/public_info/public/kids/pdf/balmes.pdf

USFA, DHS, Exposing an Invisible Killer: The Dangers of Carbon Monoxide

www.usfa.dhs.gov/citizens/co/fswy17.shtm

Centers for Disease Control and Prevention (CDC), Carbon Monoxide Poisoning Fact Sheet

www.cdc.gov/co/faqs.htm

Agency for Toxic Substances Disease Registry, CDC, ToxFAQs for Carbon Monoxide

www.atsdr.cdc.gov/toxfaqs/tf.asp?id=1163&tid=25

American Lung Association, Carbon Monoxide Indoors

www.lungusa.org/healthy-air/home/resources/carbon-monoxide-indoors.html

US Consumer Product Safety Commission (CPSC), Carbon Monoxide Questions and Answers

www.cpsc.gov/cpsc/pub/pubs/466.html

CHAPTER III FORMALDEHYDE

What is formaldehyde?

Formaldehyde is a colorless, pungent gas that is soluble in water and most organic solvents. It is used as a raw material in the manufacture of building materials, many consumer products, and some fabrics. Formaldehyde is found in the outdoor air at an average concentration of approximately 3 parts per billion (ppb) or 3.7 micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$).

How is formaldehyde harmful?

The Office of Environmental Health Hazard Assessment (OEHHA) has concluded that exposures to formaldehyde can cause cancer in humans. In 2004, the International Agency for Cancer Research upgraded formaldehyde to a Group I (known human) carcinogen, based on human epidemiology studies of nasopharyngeal cancer. Exposure to airborne formaldehyde may also cause other illnesses, such as irritation to the eyes, skin, and respiratory tract; coughing; sore or burning throat; nausea; and headaches. Formaldehyde may also worsen asthma or allergy symptoms in those with such pre-existing sensitivities. Reducing exposures to formaldehyde will reduce these health risks.

What levels of formaldehyde are found in the home?

The average formaldehyde concentration inside California homes is about 14 ppb ($17 \mu\text{g}/\text{m}^3$) in conventional homes and 37 ppb ($45 \mu\text{g}/\text{m}^3$) in manufactured homes. Formaldehyde concentrations have been measured at levels greater than 200 ppb ($246 \mu\text{g}/\text{m}^3$) in both manufactured and new conventional homes. However, concentrations inside manufactured homes are generally higher than those in conventional homes due to the increased use of composite wood products.

What are the sources of formaldehyde in the home?

Indoor sources are the major cause of exposures to formaldehyde because people spend most of their time indoors, and there are many indoor sources of formaldehyde that typically produce concentrations several times higher than outdoor levels. Composite wood products are probably the greatest source of formaldehyde in the home. Other sources include other building materials such as some paints, coatings, and wallpaper; some consumer products such as fingernail products; permanent pressed fabric such as clothing and draperies; and combustion sources such as cigarettes and gas appliances.

What are composite wood products?

Plywood, particleboard, and oriented strandboard are composite wood products that are bound together with formaldehyde-containing resins. The two most commonly used resins are urea-formaldehyde and phenol-formaldehyde. Composite wood products used within the home include:

- # Particleboard - used for cabinetry, subflooring, shelving, and furniture
- Hardwood plywood - used in paneling, furniture, and as a wall covering
- # Medium density fiberboard - used in cabinets, doors, table tops, furniture, and shelving
- # Oriented strandboard and softwood plywood - used for exterior use and subflooring, which are manufactured using low-emitting phenol-formaldehyde resins

Why is formaldehyde emitted from these products?

In the production of the resins, not all formaldehyde is bound tightly. Unbound or free formaldehyde can be released later as a gas from composite wood products. Formaldehyde emissions are highest from products made with urea-formaldehyde resins and new products. Emissions ordinarily decrease to low levels over time, as the product ages and off-gasses. If properly manufactured, composite wood products that incorporate phenol-formaldehyde resins do not release significant amounts of formaldehyde.

Is urea-formaldehyde foam a significant source of formaldehyde in homes?

Urea-formaldehyde foam insulation (UFFI) was installed in the wall cavities of some homes during the 1970s and has been used in the manufacture of mobile homes. The Consumer Product Safety Commission banned the use of UFFI in homes and schools in 1982. Although a Federal Court subsequently removed this ban for procedural reasons, UFFI is not currently being installed in homes in California because it does not meet the insulation standards of the California Energy Commission. In homes where UFFI was installed prior to 1982, formaldehyde concentrations have declined with time to levels that are generally comparable to those in homes without UFFI.

How can formaldehyde be detected and measured?

Levels of formaldehyde can be measured by chemical analysis of air samples collected indoors. In general, ambient air monitoring of formaldehyde is done on a 24-hour or several day basis using standard analytical techniques and methods established by federal and state agencies. A useful indicator of the presence of indoor formaldehyde is knowledge of the formaldehyde content or emissions of products. This information can usually be obtained from the manufacturer. In general, you do not need to measure formaldehyde levels if there are few or no materials in the building known to emit high levels of formaldehyde, because levels would then be expected to approach the lower outdoor levels. However, if known or suspected sources are extensively present and cannot be readily removed, it is wise to measure the levels of formaldehyde, to assure that levels are no greater than 7 ppb (9 µg/m³).

Is there a safe level of formaldehyde?

Most people experience eye and throat irritation when exposed to formaldehyde at levels above 100 ppb (123 $\mu\text{g}/\text{m}^3$). Because people differ in their sensitivity to toxic effects, it is difficult to precisely define a concentration of formaldehyde that would be harmless to all people under all circumstances.

Levels in the outdoor air may be considered as the lowest levels that can practicably be achieved in the home. OEHHA has established acute (55 $\mu\text{g}/\text{m}^3$, or 44 ppb, one-hour average) and chronic (9 $\mu\text{g}/\text{m}^3$, or 7 ppb, long-term average) exposure levels to identify the levels at which sensitive individuals might experience adverse non-cancer health effects. For indoor environments, OEHHA has also identified 7 ppb as the eight hour average level that is protective against non-cancer effects for sensitive individuals. Because formaldehyde may cause cancer, and there is no known level that is absolutely risk free, the California Air Resources Board (ARB) recommends that indoor formaldehyde levels be reduced as much as possible.

What can be done to reduce indoor formaldehyde levels?

Immediate measures include opening windows to increase ventilation and reducing the number of new composite wood products in a home. Where possible, replace composite wood products such as bookcases with products made from solid wood or non-wood materials. Formaldehyde emissions increase with increasing humidity and temperature. Therefore, reducing the temperature and humidity in the home will reduce formaldehyde levels.

Where the source of formaldehyde is wood paneling or extensive cabinetry, these measures may not be adequate. In those cases, removal of the paneling or coating, or replacement of cabinets may be necessary. Local trade organizations and builders' associations may be helpful in finding a contractor to do this work. You can find additional suggestions for reducing indoor formaldehyde levels in the publications listed below.

Publications:

Formaldehyde in the Home-Indoor Air Quality Guideline #1, updated August 2004, www.arb.ca.gov/research/indoor/guidelines.htm

OEHHA, Appendix D. Individual Acute, 8-Hour, and Chronic Reference Exposure Level Summaries, December 2008,

www.oehha.ca.gov/air/hot_spots/2008/AppendixD1_final.pdf#page=128

Determination of Formaldehyde and Toluene Diisocyanate Emissions from Indoor Residential Sources, www.arb.ca.gov/research/apr/past/indoor.htm, click on Toxic Air Contaminants, scroll down.

***Final Report on the Identification of Formaldehyde as a Toxic Air Contaminant
-1992.***

These free publications are available from:

California Air Resources Board, Research Division, Indoor Exposure Assessment Section
P.O. Box 2815

Sacramento, CA 95812

Telephone: (916) 322-8282 (For first two publications listed)

Telephone: (916) 322-7072 (For third publication listed)

Web: www.arb.ca.gov

***The Inside Story - A Guide to Indoor Air Quality
An Update on Formaldehyde***

These free publications are available from:

Indoor Air Quality Information Clearinghouse

P.O. Box 37133

Washington, D.C. 20013-7133

Telephone: (800) 438-4318

FAX: (202) 484-1510

E-mail: iaqinfo@aol.com

Web: www.epa.gov/iaq/

***A Consumers Guide to Manufactured Housing
Manufactured Housing for Families***

These free publications are available from:

California Department of Housing and Community Development

Division of Administration

P.O. Box 31

Sacramento, CA 95812-0031

Telephone: (916) 445-3338

Web: www.hcd.ca.gov

Note: Telephone numbers and prices were correct at the date of publication of this booklet, but are subject to change.

CHAPTER IV HAZARDOUS WASTE

What is hazardous waste?

Hazardous waste is anything left over from a manufacturing process, chemical laboratory, or a commercial product that is dangerous and could hurt people, animals, or the environment. Many industries, such as oil and gas, petrochemical, electronics, dry cleaners, and print shops, generate hazardous waste.

When hazardous waste is properly managed it is shipped to special facilities for treatment, storage, disposal, or recycling. Hazardous waste that is not properly managed may escape into the environment and contaminate the soil, surface and ground water, or pollute the air. Some causes of hazardous waste releases are leaking underground storage tanks, poorly contained landfills or ponds, hazardous waste spills, or illegal dumping directly on land or water.

What is California doing to locate and clean up hazardous waste sites?

The U.S. EPA has targeted about 1,200 sites nationwide for federal cleanup under the federal Superfund Program. Almost 100 of those sites are in California. California is overseeing the cleanup of hundreds of other sites under a state Superfund administered by the California Department of Toxic Substances Control (DTSC). DTSC works jointly with U.S. EPA and other state agencies, such as the California Regional Water Quality Control Boards and local health departments, to manage hazardous waste problems. The primary purpose of site cleanup and mitigation activities at hazardous waste sites is to reduce or eliminate the risks the sites pose to public health or the environment.

How can the prospective homeowner determine if a home is affected by a hazardous waste site?

State law requires certain written disclosures to be made to prospective homeowners. The seller is required to disclose whether he or she is aware that the property has any environmental hazards such as asbestos, formaldehyde, radon, lead-based paint, fuel or chemical storage tanks, or contaminated soil or water. You can find additional information on real estate disclosure "Disclosures in Real Property Transactions" available from the California Department of Real Estate. See Appendix A in this document for information on how to contact them.

A prospective homeowner may also get information about hazardous waste sites near a home by consulting the "Hazardous Waste and Substances Sites List" which is maintained by the California Environmental Protection Agency (CalEPA). The list is a comprehensive inventory of hazardous waste sites in California, including contaminated wells, leaking underground storage tanks, and sanitary landfills from which there is a known migration of hazardous waste. It also lists active federal and state hazardous waste sites scheduled for cleanup as well as potential hazardous waste sites.

Information on how you can get a copy of this list is at the end of this chapter. The addresses of federal and state agencies that manage hazardous waste programs are listed in Appendix A.

A homeowner or prospective homeowner may choose to hire a registered environmental assessor to investigate a known or suspected environmental hazard at a property. To obtain a list of registered environmental assessors, contact the Registered Environmental Assessor Program at:

P.O. Box 806
Sacramento, CA 95812-0806
Telephone: (916) 324-6881
FAX (916) 324-1379
Web: www.dtsc.ca.gov/rea/

Internet Resources:

You can learn more about the role of the Department of Toxic Substances Control in protecting Californians from hazardous waste by visiting its Web site at

www.dtsc.ca.gov.

Department of Toxic Substances Control Envirostor Database can be accessed at

<http://www.envirostor.dtsc.ca.gov/public/>.

The Federal database of potentially contaminated sites is available at

www.epa.gov/superfund/sites/index.htm.

The Hazardous Waste and Substances Sites List (Cortese List) on the locations of hazardous materials release sites is at

www.dtsc.ca.gov/database/Calsites/Cortese_List.cfm.

The List of Leaking Underground Storage Tanks is available on the Web at

www.geotracker.waterboards.ca.gov.

Hotlines:

For information on the federal Superfund program and the National Priorities List (NPL), contact the U.S. EPA RCRA, Superfund, EPCRA hotline at:

Telephone: (800) 424-9346

Publications:

Disclosures in Real Property Transactions

This publication is available for \$2.00 plus tax from:

California Department of Real Estate Book Orders

P.O. Box 187006

Sacramento, CA 95818-7006 (Mail orders only; a self-addressed envelope is required.)

Web: http://www.dre.ca.gov/pdf_docs/re6.pdf

List of Registered Environmental Assessors

This list is free if you are hiring a registered environmental assessor. If you wish to use it as a mailing list, it is available on CD for \$6.25 and as a hard-copy printout for \$35.00. It's also available free on our Web site at:

www.dtsc.ca.gov/rea

Department of Toxic Substances Control
Registered Environmental Assessor Program
P.O. Box 806
Sacramento, CA 95812-0806
Telephone: (916) 324-6881

The Toxics Directory: References and Resources on the Health Effects of Toxic Substances

This publication is available for \$9.90 from:

California Department of General Services
Documents and Publications

P.O. Box 1015

North Highlands, CA 95660

(Send written request with your name and street address. Make your check out to Procurement Publications.)

Ensuring Safe Drinking Water (600M91012)

This free publication is available from:

U.S. Environmental Protection Agency

Public Information Center

1200 Pennsylvania Ave, N.W.

Washington, D.C. 20460

Telephone: (800) 490-9198

Consumer's Guide to California Drinking Water

This publication is available for \$4.00 (plus 5% shipping charge and tax) from:

Local Government Commission

1414 K Street, Suite #600

Sacramento, CA 95814

Telephone: (916) 448-1198 x307

Web: www.lgc.org

Is Your Drinking Water Safe? (PB94-203387)

This publication is available for \$19.50 plus \$4.00 shipping from:

National Technical Information Service

5285 Port Royal Road

Springfield, VA 22161

Telephone: (800) 553-6847

Web: www.ntis.gov

Note: Telephone numbers and prices were correct at the date of publication of this booklet, but are subject to change.

CHAPTER V HOUSEHOLD HAZARDOUS WASTE

What is household hazardous waste?

Although hazardous waste is usually associated with industrial or manufacturing processes, each year Californians discard tons of hazardous wastes in trash cans or down the drain. To determine whether a product is hazardous, ask yourself these questions:

- # Is it poisonous when swallowed, touched, or inhaled?
- # Does it catch fire easily?
- # Is it corrosive? Can it eat through certain containers?
- # Is it reactive? Could it explode if it is improperly stored, spilled, or mixed with other products?

If you answer yes to any these questions, then the product is hazardous. Information about whether a product is hazardous usually can be found on the container label. The words "caustic," "flammable," "toxic," and "ignitable" mean that the product is hazardous.

Some products are hazardous on their own, but can become even more dangerous when they are mixed with other household products. For example, most people know that bleach is poisonous, but when it is mixed with ammonia-based cleaners it releases chlorine and hydrazine gases, both of which are extremely poisonous.

Some other hazardous household products are:

- # Cleaning products containing ammonia
- # Chlorine bleach and cleaning products containing it
- # Drain cleaners
- # Carpet cleaning products
- # Oven cleaners
- # Metal polishes
- # Garden supplies such as weed and insect killers, rat poison, and fertilizer
- # Charcoal lighter fluid, and kerosene
- # Automotive supplies such as antifreeze, motor oil, gasoline, batteries and brake fluid
- # Paint, varnish, paint removers, glues, and waxes
- # Electronic products such as cathode ray tubes, televisions, computers, cell phones
- Universal wastes such as fluorescent lights, small batteries, and products containing mercury

How should hazardous household products be stored?

Hazardous products should be stored in a cool, dry, secure location. They should be stored in locked cupboards, locked drawers, or on a high shelf out of the reach of children and pets. To prevent hazardous products from spilling during an earthquake, shelves should be firmly secured to the wall and have a restraining bar along the side.

The following guidelines will help you properly store household hazardous products:

- # Store poisonous products apart from other products.
- # Sort products into hazardous waste categories of poisonous, flammable, corrosive, and reactive and store them separately. For example, flammable products such as charcoal lighter and waste oil should be stored apart from corrosive products such as drain cleaner and acid batteries. It is important to store reactive products in a separate location.
- # Store bleach and ammonia-based cleaners in separate cupboards, so that if there is a spill the products won't get mixed and release poisonous gas.
- # Store products in their original containers.
- # Make sure labels can be read and won't come off the container.
- # Tightly seal containers and check them often to make sure they are not breaking down. If you notice a container is rusting or leaking, put it inside a larger container and label it clearly.

What is the best way to dispose of household hazardous waste?

The best way to dispose of household hazardous waste is to take it to a community household hazardous waste collection center in your area.

You should never pour unused hazardous household products down the drain. That is illegal in California. It is also illegal to pour used oil and paints on land, down drains, including the storm drains, or to burn them. Waste motor oil, oil filters, antifreeze, and used batteries can be recycled. You should take them to a recycling center or a household hazardous waste collection center. For information about recycling specific products or about household hazardous waste collection programs in your community, call

1-800-CLEANUP or visit the

Department of Resources Recycling and Recovery (CalRecycle) Web site at <http://www.calrecycle.ca.gov/>. You can get additional information on household hazardous waste at www.earth911.org.

Hotlines:

For information on household hazardous waste and used oil collection and recycling centers, information on buying recycled products, the 3 R's - Reduce, Reuse and Recycle, and other environmental tips and events, contact the California Environmental Hotline at:

Telephone: 1-800-CLEANUP (1-800-253-2687)

Web Site: www.1800cleanup.org

For information on recycling and collection centers and referrals for county and city agencies, call the California Integrated Waste Management Board at:

Telephone: (800) 553-2962

To report hazardous waste violations, call the California Department of Toxic Substances Control Waste Alert hotline at:

Telephone: (800)-69TOXIC [(800) 698-6942]

For general information on hazardous wastes, call the California Department of Toxic Substances Control at:

Telephone: (800) 61TOXIC [(800) 618-6942]

Publications:

Household Products Management Wheel

This product is available for \$4.95 from:

Environmental Hazards Management

Institute 10 New Market Road

P.O. Box 932

Durham, NH 03824

Telephone: (603) 868-1496

FAX: (603) 868-1547

Note: Telephone numbers and prices were correct at the date of publication of this booklet, but are subject to change.

CHAPTER VI LEAD

How is lead harmful?

Lead is a common environmental toxin that has been used extensively in consumer products such as paint and gasoline. Much of that lead remains in the California environment where people may be exposed to it. Children under the age of six years are particularly at risk. They typically are exposed to lead through the normal hand-to-mouth behavior that occurs as they explore their environment. Crawling or playing on the floor, and putting their fingers, toys, and other items in their mouths can expose a child to lead. Lead poisoning, which is often unrecognized, can result in health effects that are often irreversible, including brain damage, mental retardation, convulsions, and even death. If lead poisoning goes undetected, it may result in behavior problems, reduced intelligence, anemia, and serious liver or kidney damage.

Lead is also harmful to adults. Lead poisoning can cause reproductive problems in both men and women, high blood pressure, kidney disease, digestive problems, nerve disorders, memory and concentration problems, and muscle and joint pain. Adult lead poisoning is most often the result of occupational exposure, or exposure following unsafe home renovation. If a pregnant woman is lead poisoned, the lead can pass into her baby's blood and poison the baby.

How can I find out if my family has lead poisoning?

The most important step you can take to protect your children is to prevent them from being exposed to lead. Most lead poisoning does not cause acute symptoms, so the only way to know if a person is lead poisoned is by testing the level of lead in his or her blood.

There are many ways a child can be exposed to lead. The law assumes that, at minimum, children are at risk if they are on publicly funded programs for low-income children or if they live in, or spend a lot of time in, a place built before 1978 that has peeling or chipped paint, or that has been recently renovated. These children must be tested for lead at age one and two years. Children below the age of six years, who were not tested at ages one or two, should receive make-up testing as soon as possible. If you have a job or a hobby where you may be exposed to lead, you should be tested regularly. If you are pregnant, ask your doctor about a lead test.

A physician can order this simple test. Some doctors and healthcare centers can perform the test in their offices. Under California law, it must be covered by health insurance plans. Children from families with modest incomes can be tested at no cost through the Child Health and Disability Prevention Program (CHDP). The test is a required part of well-child checkups. For more information on CHDP and to locate an office in your area visit their Web site at www.dhs.ca.gov/pcfh/cms/chdp.

Because lead poisoning is the result of contact with lead, the primary treatment is to identify the source of lead, and remove or isolate it. Further medical management may be necessary, depending on factors such as the severity and duration of exposure. Adults and children who become lead poisoned will need regular testing to monitor levels of lead in the body.

Where is lead found in the home?

Many houses and apartments built before 1978 have paint that contains lead. In 1978, the Consumer Product Safety Commission banned paint containing high levels of lead for residential use. If your home or apartment was built before 1978, you should assume it has lead paint.

Lead-based paint that is peeling, chipping, chalking, or cracking is a hazard and needs immediate attention. Lead-based paint may also pose a hazard on surfaces children can chew or in areas with heavy wear. These areas include windows, windowsills, doors and doorframes, stairs, railings, banisters, porches, and fences. When painted surfaces bump or rub together, they generate lead dust. Likewise, dry-scraping, sanding, or heating lead paint during repainting or remodeling also creates large amounts of lead dust. This dust can poison your family.

Soil may be contaminated with lead from leaded gasoline emissions and from deteriorating exterior paint. Lead in soil can be a hazard to children who play in the bare soil. It can also contaminate the home and floor dust when people track soil into the house on their shoes.

Other Sources: Lead can be found in jobs such as battery repair or recycling, radiator repair, painting or remodeling, and lead smelting. Lead from the workplace poses a hazard for workers' families. Workers can bring lead into their homes on their work clothes, shoes, and bodies without knowing it. Some hobbies also use lead. These include ceramics, stained glass, fishing weights, and bullet casting or firing. Lead can leach into food cooked, stored, or served in some imported dishes or handmade pottery. Some traditional remedies such as Azarcon, Greta, Pay-loo-ah, Surma, Kohl, and Kandu contain large amounts of lead and present a serious danger. Imported candy, especially chili or tamarind candy or its packaging, is frequently lead contaminated. Lead has been found in painted toys and inexpensive costume jewelry, particularly imported items. Older water systems may have pipes containing lead or pipes with lead solder.

How can I check my home for lead hazards?

To inspect your home for lead hazards, hire an individual who has been certified by the California Department of Public Health (CDPH). CDPH certification is now required for all those doing lead hazard evaluations, lead abatement plan preparation, lead abatement work and lead clearance inspections for residential and public buildings in California ([Title 17, CCR § 35001-35050 and § 36000-36100](#)). A CDPH-certified inspector/assessor

can determine the lead content of painted surfaces in your home and identify sources of lead exposure such as peeling paint, lead contaminated soil, or lead-contaminated dust. The assessment should outline the actions to take to address these hazards.

A CDPH-certified inspector/assessor may use a variety of methods to assess lead hazards in your home. These include visual inspection of paint condition; laboratory tests of paint, dust and soil samples; and a portable x-ray fluorescence lead testing (XRF) machine.

You may have seen home lead test kits in your local hardware store. Recent studies suggest, however, that they are not accurate for testing paint, soil, or dust. They may be used, however, to test pottery and ceramics for the presence of lead.

How can I reduce lead hazards safely?

If your house has lead hazards, you can take action to reduce your family's risk. Most importantly, if you have young children, be sure they receive a blood lead test. This is particularly critical if you live in a unit that has been recently renovated or have remodeled your home.

Second, keep your home as clean and free of dust and deteriorated paint chips as possible. Clean floors, window frames, windowsills, and other horizontal surfaces weekly. Use a mop, sponge, or disposable cloths with a solution of water and an all-purpose cleaner. Rinse out mops and sponges thoroughly after use. Use doormats or remove shoes before entering your home to avoid tracking in lead from bare soil. Have children play in grassy or landscaped areas instead of bare soil.

Wash children's hands often, especially before meals and bedtime. Keep play areas clean. Wash bottles, pacifiers, toys, and stuffed animals regularly. Feed your children nutritious meals that include foods high in iron and calcium. Give children regular meals and snacks. Children with full stomachs and nutritious diets tend to absorb less lead.

How can I significantly reduce lead hazards?

In addition to regular cleaning and good nutrition, you can **temporarily** reduce lead hazards by repairing damaged painted surfaces and planting grass or using landscaping materials to cover soil with high lead levels. These actions are not permanent solutions and need ongoing attention.

To **permanently** remove lead hazards, you should hire a lead abatement contractor. Abatement methods include removing, sealing, or enclosing lead-based paint with special materials. Simply painting over lead-based paint with regular paint is not a permanent solution. Hire an individual who has been certified by the CDPH as a Supervisor. CDPH-certified Supervisors and Workers have the proper training to do this work safely.

They have the proper equipment to clean up thoroughly. They will also follow strict safety rules set by the state and federal governments.

What precautions should I take when remodeling my home?

Before you begin any remodeling or renovations that will disturb painted surfaces, (such as scraping or sanding paint, or tearing out walls) test the area for lead-based paint. To fully protect your family from unsafe renovation hazards, hire a CDPH-certified Supervisor.

Never use a dry scraper, belt-sander, propane torch, or heat gun to remove lead-based paint. These actions create large amounts of poisonous lead dust and fumes. This lead dust can remain in your home long after the work is done, and can make your family very sick. It is important to move your family (especially children and pregnant women) out of the home until the work is completed and the area has been properly cleaned.

You can find out about other safety measures by calling (800) 424-LEAD [(800) 424-5323]. Ask for the brochure "Reducing Lead Hazards when Remodeling Your Home." This brochure explains what to do before, during, and after renovations.

What is the source of lead in water?

The source of lead in water is most likely to be lead in water pipes, lead solder used on copper pipes, and some brass plumbing fixtures. Lead pipes are generally found only in homes built before 1930. The use of lead-based solder in plumbing applications in homes and buildings was banned in 1988. However, many homes built prior to 1988 may contain plumbing systems that use lead solder. The levels of lead in water from these homes are likely to be highest during the first five years after construction. After five years there can be sufficient mineral deposit, except where the water is soft, to form a coating inside the pipe; this coating prevents the lead from dissolving. However, recently, new chemical agents being used in some water systems have been associated with increased corrosion and have resulted in increased levels of lead in water.

How can lead levels in water be determined?

If you suspect lead contamination in drinking water, you may submit water samples to a laboratory certified by the CDPH. For a list of certified laboratories, see Publications at the end of this chapter. Consult with the laboratory on the proper procedures for sample taking. Information on the possibility of lead contamination in your municipal water supply may be obtained from the water utility serving your area.

How can levels of lead in water be reduced?

Lead levels in water can be reduced by removing lead piping or lead solder, by installing a home treatment system certified by the CDPH, or regularly flushing each tap before consuming the water. Another alternative for homeowners is to purchase bottled water. A detailed discussion of home treatment systems is presented in, "Consumers Guide to California Drinking Water" (see Publications).

Where there are elevated lead levels in water, homeowners who choose not to install a treatment system, or use bottled drinking water, should flush each tap before the water is consumed. Water which has been standing in the water pipes for more than six hours should be flushed from the tap until the temperature changes, and then, for about 15 seconds more. Because lead is more soluble in hot water, the homeowner should not drink or prepare food using hot water from the tap. The flushed water should be saved and used for other purposes, such as washing clothes or watering plants.

What are my responsibilities if I am selling, renting, or remodeling a home built before 1978?

If you are planning to buy, rent, or renovate a home built before 1978, federal law requires sellers, landlords, and remodelers to disclose certain information prior to finalizing contracts.

Landlords must:

- # Disclose known information on lead-based paint hazards.
- # Give you a lead hazard pamphlet before leases take effect. Leases must also include a federal form about lead-based paint.

Sellers must:

- # Disclose known information on lead-based paint hazards.
- # Give you a lead hazard pamphlet before selling a house. Sales contracts must also include a federal form about lead-based paint. Buyers have up to 10 days to check for lead hazards.

Renovators must:

- # Give you a lead hazard pamphlet before starting to work.

If you want more information on these requirements, call the National Lead Information Clearinghouse at (800) 424-LEAD [(800) 424-5323].

Hotlines:

For more information on lead in drinking water and information on federal regulations about lead in drinking water, contact the U.S. EPA Safe Drinking Water Hotline in

Washington, D.C. at:

Telephone: (800) 426-4791

For information on how to protect children from lead poisoning, contact The National Lead Information Center at:

Telephone: (800) Lead-FYI [(800) 532-3394]

For other information on lead hazards, call The National Lead Information Center Clearinghouse at:

Telephone: (800) 424-LEAD [(800) 424-5323]

To request information on lead in consumer products, or to report an unsafe consumer product or a product-related injury, contact the Consumer Product Safety Commission at:

Telephone: (800) 638-2772

To request local lists of CDPH-certified inspectors or abatement workers, contact the Lead-related Construction Hotline at:

Telephone: (800) 597-LEAD [(800) 597-5323] or visit the CDPH Web site at www.cdph.ca.gov

To obtain additional information on lead poisoning, or a list of local county lead programs, contact the CDPH Childhood Lead Poisoning Prevention Branch at:

Telephone: (510) 620-5600 or visit the CDPH Web site at

www.cdph.ca.gov/programs/CLPPB.

Publications:

List of Certified Laboratories to Perform Hazardous Waste Analysis

This free list is available from:

California Department of Health Services

Environmental Laboratory Accreditation Program

850 Marina Bay Parkway, Ste. G365/EHL

Richmond, CA 94804

Telephone: (510) 620-2800

Web: www.cdph.ca.gov/certlic/labs/Documents/ELAPLablist.xls

Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing

This publication is available for \$45.00 from:

Department of Housing and Urban Development (HUD)

Information Services, HUD User

P.O. Box 6091

Rockville, MD 20849

Telephone: (800) 245-2691

Web: www.huduser.org

Lead in your Drinking Water

This publication is available from:

U.S. Environmental Protection Agency
Public Information Center
1200 Pennsylvania Ave., N.W.
Washington, D.C. 20460
Telephone: (202) 272-0167

The Inside Story - A Guide to Indoor Air Quality

This free publication is available from:
Indoor Air Quality Information Clearinghouse
P.O. Box 37133
Washington, D.C. 20013-7133
Telephone: (800) 438-4318
Web: www.epa.gov/iaq/

Consumers Guide to California Drinking Water

This publication is available for \$4.00 (plus 5 percent shipping charge, and tax) from:
Local Government Commission
1414 K Street, Suite #250
Sacramento, CA 95814
Telephone: (916) 448-1198 x 307
Web: www.lgc.org

Lead Poisoning Prevention Wheel

This publication is available for \$3.95 from:
Environmental Hazards Management Institute
10 New Market Road
P.O. Box 932
Durham, NH 03824
Telephone: (603) 868-1496

Note: Telephone numbers and prices were correct at the date of publication of this booklet, but are subject to change.

CHAPTER VII MOLD

What are molds?

Molds are simple, microscopic organisms present virtually everywhere, indoors and outdoors. Molds, along with mushrooms and yeasts, are fungi and are needed to break down dead material and recycle nutrients in the environment.

For molds to grow and reproduce, they need only a food source - any organic material, such as leaves, wood, paper, or dirt - and moisture. Because molds grow by digesting organic material, they gradually destroy whatever they grow on. Sometimes, new molds grow on old mold colonies. Mold growth on surfaces can often be seen in the form of discoloration, frequently green, gray, brown, or black but also white and other colors. Molds release countless tiny, lightweight spores, which travel easily through the air.

How am I exposed to indoor molds?

Everyone is exposed to some mold on a daily basis without evident harm. There are usually mold spores in the air inside homes. Most indoor mold spores come from outdoors by blowing through open windows or being tracked into homes as dust on shoes. Mold spores primarily cause health problems when they are present in large numbers and people inhale high concentrations of spores in air. This can occur when there is active mold growth in a home, office, or school where people live or work. People can also be exposed to mold by touching moldy materials and by eating contaminated foods. Molds will grow and multiply whenever conditions are right, that is when sufficient moisture is available and organic material is present. The most important factor allowing mold to grow is dampness or moisture accumulation in the home. The following are common sources of indoor moisture that may lead to mold problems:

- # Flooding
- # Leaky roofs
- # Sprinkler spray hitting the house
- # Plumbing leaks
- # Overflow from sinks, showers, bathtubs, or sewers
- # Damp basement or crawl space
- # Steam from bathing, doing laundry, or cooking
- # Humidifier use
- # Wet clothes drying indoors or clothes dryers exhausting hot, humid air indoors

Warping floors and discoloration of walls and ceilings can be indications of moisture problems. Condensation on windows or walls is also an important indication, but it can sometimes be caused by an indoor combustion problem. Have fuel-burning appliances routinely inspected by your local utility or a professional heating contractor.

Should I be concerned about mold in my home?

Yes, if indoor mold growth is extensive, it can cause very high and persistent airborne spore exposures. Persons exposed to high spore levels can become sensitized and develop allergies to the mold or other health problems. Mold growth can also damage your furnishings, such as carpets, sofas, and cabinets. Clothes and shoes in damp closets can become soiled. In time, unchecked mold growth can cause serious damage to the structure of your home.

What symptoms are commonly seen with mold exposure?

Exposure to large amounts of mold can cause health effects through inflammation, allergic response, or, rarely, infection. Allergic reactions, often referred to as hay fever, are the most common health problems reported following mold exposure. Typical symptoms that mold-exposed persons report, alone or in combination, include:

- # Breathing problems, such as wheezing, difficulty breathing, and shortness of breath
- # Nose or sinus congestion (stuffy feeling, sinus headache)
- # Eye irritation (burning, watery, or reddened eyes)
- # Dry, hacking cough
- # Nose or throat irritation (runny nose, sneezing, sore throat)
- # Skin rashes or red, itchy skin

Headaches, memory problems, mood swings, nosebleeds, body aches and pains, and fevers are occasionally reported in mold cases, but their cause is not understood.

How much mold can make me sick?

For some people, encountering even a relatively small number of mold spores can trigger an asthma attack or lead to other health problems. For other persons, symptoms may occur only when exposure levels are much higher. Nonetheless, indoor mold growth is unsanitary and undesirable. Basically, if you can see or smell mold inside your home, take steps to identify and eliminate the excess moisture and to cleanup and remove the mold.

Are some molds more hazardous than others?

Allergic persons have different levels of sensitivity to molds, both as to the amount and the types that cause them to feel ill. In addition to being able to cause allergies, certain types of molds, such as *Stachybotrys chartarum*, may produce compounds that have toxic properties, which are called mycotoxins. Mycotoxins are not always produced, and whether a mold produces mycotoxins while growing in a building depends on what the mold is growing on as well as environmental conditions such as temperature, humidity, and other unknown factors. When mycotoxins are present, they occur in both living and

dead mold spores and may be present in materials into which mold has grown. While *Stachybotrys chartarum* and some other types of molds are growing, a wet slime layer covers the spores, preventing them from becoming airborne. However, when the mold dies and dries up, air currents or physical handling can cause spores to become airborne.

At present there is no readily available, inexpensive test to determine if a mold growing in a building is producing toxins. A limited number of specialized laboratories can test for mycotoxins in dust or building materials such as gypsum wallboard. These tests are very expensive and the results are not helpful in determining if there is an additional health risk from mycotoxins. There are also no blood or urine tests that a physician can use to determine if an individual has been exposed to the spores of a toxin-producing fungus or its mycotoxins.

How can I tell if I have mold in my house?

You may suspect that you have mold if you see discolored patches or cottony or speckled growth on walls or furniture or if you smell an earthy or musty odor. You also may suspect mold contamination if mold-allergic individuals experience some of the symptoms listed earlier when in the house. Evidence of past or ongoing water damage should also trigger a more thorough inspection. You may find mold growth underneath water-damaged surfaces or behind walls, floors, or ceilings.

Should I test my home for mold?

The California Department of Public Health (CDPH) does not recommend testing as a first step to determine if you have a mold problem. Reliable air testing for mold can be expensive and requires experience and equipment that is not available to most people. Owners of individual private homes and apartments generally will need to pay a contractor to do such testing, because insurance companies and public health agencies seldom provide this service. Mold inspection and cleanup is usually considered a housekeeping task that is the responsibility of the homeowner or landlord, as are roof and plumbing repairs, house cleaning, and yard maintenance.

Another reason the CDPH does not recommend testing for mold is that there are few available standards for judging what is an acceptable amount of mold. In all locations, there is some level of airborne mold outdoors. If air testing is carried out in a home, an outdoor air sample also must be collected at the same time, to allow comparison of indoor and outdoor spore types and numbers. Because some people are much more sensitive to mold spores than are other people, mold testing is at best a general guide. The simplest way to deal with a suspicion of mold contamination is, if you can see or smell mold, you likely have a problem and should take the steps outlined below. Mold growth is likely to recur unless the source of moisture that is allowing mold to grow is removed and the contaminated area is cleaned.

Assessing the Size of a Mold Contamination Problem

There will be a significant difference in the cleaning recommendations for a small mold problem - total area of visible mold growth is less than 10 square feet - and a large mold problem - more than 100 square feet. In the case of a relatively small area, the homeowner using personal protective equipment, such as a dust mask, safety goggles, and household gloves, can handle the cleanup. However, for larger areas, choose an experienced, professional contractor.

General Cleanup Procedures

- # Find and remove sources of moisture
- # Find and determine the extent and area of visible mold growth
- # Clean and dry moldy areas - do not allow dust from the moldy areas to get into the rest of the home
- # Bag and dispose of all material that may have moldy residues, such as rags, paper, leaves, and debris

Clean up should begin after the moisture source is fixed and excess water has been removed. Wear gloves when handling moldy materials. **Spores are more easily released when moldy materials dry out, so it is advisable to remove moldy items as soon as possible.** Detailed cleanup procedures are available in the California Department of Health Services Indoor Air Quality Section fact sheet entitled, "Mold in My Home: What Do I Do?" It is available on the Internet at www.cdph.ca.gov/programs/IAQ/Documents/MIMH_2006-06_2009-03rev6p.doc or by calling (510) 620-2874.

How can I prevent indoor mold problems in my home?

Inspect your home regularly for signs and sources of indoor moisture and mold. Take steps to eliminate sources of water as quickly as possible. If a leak or flooding occurs, it is essential to act quickly so that wet materials can dry within 48 hours:

- # Stop the source of the leak or flooding.
- # Remove excess water with mops or wet vacuum.
- # Move wet items to a dry, well-ventilated area. Move rugs and pull up wet carpet as soon as possible.
- # Open closet and cabinet doors and move furniture away from walls to increase circulation.
- # Run portable fans to increase air circulation. Do NOT use the home's central blower if flooding has occurred in it or in any of the ducts. Do NOT use fans if mold may have already started to grow, or if it has been more than 48 hours since the flooding.
- # Run dehumidifiers and window air conditioners to lower humidity.
- # Do NOT turn up the heat or use heaters in confined areas, as higher temperatures may increase the rate of mold growth.

- # If water has soaked inside the walls, it may be necessary to open wall cavities by removing the baseboards and drilling a hole through the bottom of the wet wall, or by prying away wall paneling.

Publications:

Mold in My Home: What Do I Do?

This free document is available from:
California Department of Public Health
Indoor Air Quality Section
850 Marina Bay Parkway, G365 EHLB
Richmond, CA 94804
Telephone: (510) 620-2874

Web: www.cdph.ca.gov/programs/IAQ/Documents/MIMH_2006-06_2009-03rev6p.doc

Numerous mold-related articles

and documents are available from:

California Department of Public Health
Environmental Health Investigation Branch
850 Marina Bay Parkway
Building P, 3rd floor
Richmond, CA 94804-6403

Web: www.ehib.org/search.jsp?ss=mold&google=on

***Mold Remediation in Schools and Commercial Buildings
A Brief Guide to Mold, Moisture, and Your Home***

These free documents are available from:

U.S. Environmental Protection Agency
IAQ Information Clearinghouse
Telephone: (800) 438-4318

Web: www.epa.gov/mold/moldresources.html

Repairing Your Flooded Home

This free publication is available from:

American Red Cross
8928 Volunteer Lane, Sacramento, CA 95826
Telephone: (916) 368-3131

Web: www.redcross.org

For local assistance, contact your county or city Department of Health, Housing, or Environmental Health. Phone numbers for these agencies are located in the blue government pages at the front of your local telephone directory.

Note: Telephone numbers and prices were correct at the date of publication of this booklet, but are subject to change.

CHAPTER VIII RADON

What is radon?

Radon is a naturally occurring colorless, tasteless, and odorless radioactive gas that comes from the decay of uranium found in nearly all soils. It enters buildings from the ground through cracks and openings in concrete slabs, crawl spaces, floor drains, sumps, and the many tiny pores in hollow-wall concrete blocks. When the pressure within a home is lowered, more radon can be drawn from the soil and enter the home. Indoor air pressure may be lower during colder months when heated air rises from the floor level to the ceiling or second story level in the house. Indoor pressure may also be lowered in tightly sealed houses through use of exhaust fans such as those in many kitchens and bathrooms.

Once inside a building, radon can become trapped. Unless the building is properly ventilated to remove it, the gas can become a health hazard.

Where is radon found?

Radon is typically present in rocks containing uranium such as certain granites and shales. The amount of radon that can enter soils and groundwater depends on the concentrations of uranium in the underlying rock. Radon can also be found in the air at very low concentrations.

If radon is present in tap water, it can be released when water is used indoors for showering, washing dishes, or washing clothes. Radon is of most concern when water is obtained directly from a well that draws water from a source exposed to uranium and radium. Most of the radon in water obtained from a surface source, such as a reservoir or well water stored in an open tank, has been released before it reaches the home. Building materials are not a significant source of radon except where they incorporate rocks rich in radium or uranium such as granite and shales.

Why is radon harmful?

Long-term exposure to elevated levels of radon can increase your risk of getting lung cancer. Tobacco smokers are at an even greater risk. Radon levels vary throughout the country. The amount of radon entering homes varies from home to home. Because radon is colorless, odorless, and tasteless, testing is the only way to find out if you and your family are at risk from it.

Exposure to radon does not result in any immediate symptoms. For example, it does not result in acute respiratory effects such as colds or allergies. Any cancer resulting from inhaling radon is not likely to arise for at least 20-30 years after exposure begins, and both the level of exposure and duration of exposure are factors which determine the risk of developing lung cancer.

Where are the highest levels of radon in the home?

Generally, the living area closest to the soil surface has the highest level of radon. Upper stories have lower levels of radon. Consequently, radon is rarely a concern in high rise apartment buildings, other than at ground level.

Do adjacent houses have similar levels of radon?

Because the amount of uranium and radium in the soil varies, and because houses are constructed and used in different ways, houses in the same neighborhood will have different radon levels.

Is there a safe level of radon?

We know that the greater the exposure to radon, the greater the risk of developing lung cancer. But we do not know if there is a radon level that is harmless. Both the duration of exposure and the level of radon in the air are important in determining the risk of developing lung cancer. Smoking may be a large contributing factor to lung disease associated with radon exposure. Currently, the California Department of Public Health (CDPH) **recommends that you take action to reduce radon levels in your house if the annual average indoor air concentration exceeds 4 picocuries per liter (pCi/L).**

How can radon levels be measured?

Several types of passive radon detectors or active devices can measure the level of radon in a house. Passive detectors are devices left in place for a period of time that require no ongoing activity or power. To obtain accurate results, the homeowner should carefully follow the manufacturer's instructions. Although short-term measurements of radon levels are more convenient, health risk can be more accurately determined from measurements made over a year. Active devices require a source of power and are used by professional radon testers to monitor radon levels. These devices are usually used during real estate transactions.

Where can I get a radon detector?

The CDPH Radon Program is now offering short term test kits for \$7.00 for California residents. CDPH has contracted with Alpha Energy Laboratories ([DrHomeAir](http://DrHomeAir.com)) to provide this service. The test kit can be ordered on-line at www.drhomeair.com/. The CDPH Radon Program maintains lists of currently certified testers, mitigators and laboratories at www.cdph.ca.gov/HealthInfo/environhealth/Pages/RadonServiceProviders.aspx This list of certified radon providers can also be obtained by calling the CDPH Radon Program Hotline at (800) 745-7236.

What must be done to reduce indoor radon levels?

The U.S. EPA and CDPH recommend that homeowners attempt to reduce radon levels in any home that has an annual average level of radon at or above 4 pCi/L. The mitigation method chosen will depend on the construction of the house, extent of radon reduction required, and cost. After installing a mitigation system, we recommend that radon levels be monitored at regular intervals to make sure the mitigation is working.

A qualified contractor should install the radon mitigation system unless the homeowner fully understands the principles of the mitigation system.

When should water be tested for radon?

When a test shows that indoor levels of radon are at or above 4 picocuries per liter, homeowners should also consider a water test. If the water comes from a water system, information about the source of the water and any radon tests done on it can be obtained from the company supplying the water. For information or assistance with interpreting test results, contact the CDPH Division of Drinking Water and Environmental Management (see Appendix A) at www.cdph.ca.gov/programs/Pages/DDWEM.aspx.

The radon concentration of water from a private well can be measured by having a sample analyzed at a laboratory certified to test for radon in water. Homeowners should consult the CDPH radon program at (916) 449-5674 for guidance on the type of water analysis appropriate to the area and well type. The method of sample collection is critical. To get a list of certified laboratories, call the CDPH at (800) 745-7236 or visit their website at www.cdph.ca.gov/HealthInfo/envirohealth/Pages/RadonServiceProviders.aspx.

How can levels of radon in water be reduced?

Radon levels in water can be reduced by 99 percent by the installation of a granular activated carbon unit (GAC) on the water line entering the house. GAC units should be certified by the CDPH. As radon accumulates and decays in the GAC unit, the unit itself becomes radioactive. Therefore, these units must be shielded or located away from the house to protect occupants from radiation. The GAC filters also require special handling during replacement and disposal. Aeration may also remove radon from water. This technique may be more costly but avoids the problem of radiation build up. Selection of the proper water treatment technology depends primarily upon its removal efficiency (other contaminants in the water may adversely affect this), safety, initial costs, and operating and maintenance costs. Therefore, professional guidance is strongly advised.

Does the law require mitigation?

Mitigation of radon is not required by law and is at the discretion of the homeowner.

Hotlines:

For information on how to purchase a radon detector, how to find someone to test your home, or for informational publications on radon, call the CDPH Radon Program Hotline at: (800) 745-7236 or visit their website at

www.cdph.ca.gov/HealthInfo/environhealth/Pages/Radon.aspx

For specific assistance, call the CDPH Radon Program at: (916) 449-5674

Publications:

List of Certified Providers of Radon Services

This publication is available by calling CDPH Radon Program Hotline at (800) 745-745-7236 or at

www.cdph.ca.gov/HealthInfo/environhealth/Pages/RadonServiceProviders.aspx

California Department of Public Health

Indoor Radon Program

1616 Capitol Avenue, 2nd Floor

P.O. Box 997413

Sacramento, CA 95899-7413

Telephone: (800) 745-7236

Web: www.cdph.ca.gov/HealthInfo/environhealth/Pages/Radon.aspx

Radon in California

A Citizen's Guide to Radon

Homebuyers and Sellers Guide to Radon

The Inside Story - A Guide to Indoor Air Quality

How to Reduce Radon Levels in your Home

Model Standards for Radon in New Residential Buildings

These free publications are available from:

U.S. EPA Indoor Air Quality Information Clearinghouse

P.O. Box 37133

Washington, D.C. 20013-7133

Telephone: (800) 438-4318

Fax: (202) 484-1510

Email: iaqinfo@aol.com

Web: www.epa.gov/iaq/

Note: Telephone numbers and prices were correct at the date of publication of this booklet, but are subject to change.

Federal Agencies

**U.S. Department of Housing and Urban Development
(HUD)**

Office of Lead Hazard Control
451 7th Street S.W., Room B133
Washington, D.C. 20410
Telephone: (202) 755-1785
Web: www.hud.gov

HUD helps people build and maintain communities of opportunity.

U.S. Environmental Protection Agency (U.S. EPA)

Public Information Center
1200 Pennsylvania Ave., N.W.
Washington, D.C. 20460
Telephone: (202) 272-0167
Web: www.epa.gov

The U.S. EPA is a regulatory agency responsible for implementing federal laws designed to protect our air, water, and land from past and future environmental hazards.

State Agencies

California Air Resources Board

Research Division
Indoor Exposure Assessment Section
1001 I Street
P.O. Box 2815
Sacramento, CA 95814
Telephone: (916) 322-8282
Web: www.arb.ca.gov

California Contractor's State License Board

9821 Business Park Drive
P.O. Box 26000
Sacramento, CA 95827
Telephone: (800) 321-2752
Web: www.contractorslicense.com

This board is responsible for licensing contractors, including asbestos abatement.

California Department of Industrial Relations

Division of Occupational Safety and Health (Cal/OSHA)
Asbestos Consultant Certification Unit
2211 Park Towne Circle, #1
Sacramento, CA 95825
Telephone: (916) 574-2993
Web: www.dir.ca.gov

Cal/OSHA is the state equivalent to the Federal Occupational

Residential Environmental Hazards Booklet

**Page 40 of 48
January 2011**

Safety and Health Administration (OSHA) and regulates protection of workers.

California Department of Public Health

Call your local county health department listed in the front of the white pages or, on the Internet, visit www.cdph.ca.gov

California Department of Public Health

Environmental Management Branch, Radon Program

1616 Capital Avenue, 2nd Floor, MS 7405

P.O. Box 997413

Sacramento, CA 95899-7413

Telephone: (800) 745-7236

Web: www.cdph.ca.gov/HealthInfo/envirohealth/Pages/Radon.aspx

This branch provides publications and information about radon hazards.

California Department of Public Health

Environmental Lab Accreditation Program

850 Marina Bay Parkway

Building P, Third Floor

Richmond, CA 94804-6403

Telephone: (510) 620-5600

APPENDIX A List of Federal and State Agencies

Contact information provided was correct as of the date of publication, but is subject to change.

This office may provide information about test procedures for analyzing environmental pollutants

California Department of Public Health

Division of Drinking Water and Environmental
Management

Drinking Water Technical Program Branch

Sacramento Headquarters

1616 Capital Avenue, MS 7400

P.O. Box 997413

Sacramento, CA 95899-7413

Telephone: (916) 449-5600

This division collects and evaluates water quality information on drinking water in California and supervises the activities of all public water systems. It also provides assistance to local health departments, water purveyors, and the general public on issues related to water quality, water supply, and water treatment:

Northern California Section

Sacramento District

8455 Jackson Road, Room 120

Sacramento, CA 95826

Telephone: (916) 229-3126

Lassen, Valley, Klamath & Shasta Districts

415 Knollcrest Drive, Suite 110

Redding, CA 96002

Telephone: (916) 224-4800

North Coastal Section

San Francisco & Santa Clara Districts

2151 Berkeley Way, Room 458

Berkeley, CA 94704

Telephone: (510) 540-2158

Mendocino & Sonoma Districts

50 D Street, Suite 200

Santa Rosa, CA 95404-4752

Telephone: (707) 576-2145
Monterey District
1 Lower Ragsdale, Bldg. 1, Suite 120
Monterey, CA 93940
Telephone: (831) 655-6939

Central California Section
Merced & Visalia Districts
1040 East Herndon Avenue, Suite 205
Fresno, CA 93720-3158
Telephone: (559) 447-3300

Stockton District
31 E. Channel Street, Room 270
Stockton, CA 95202
Telephone: (209) 948-7696

Tehachapi District
1200 Discovery Drive, Suite 100
Bakersfield, CA 993309
Telephone: (661) 335-7315

Southern California Section
Los Angeles District & Metropolitan Districts
1449 W. Temple Street, Room 202
Los Angeles, CA 90026
Telephone: (213) 580-5723

Santa Barbara District
1180 Eugenia Place, Suite 200
Carpinteria, CA 93013
Telephone: (805) 566-1326

South Coastal Section
San Bernardino District
464 West 4th Street, #437
San Bernardino, CA 92401
Telephone: (909) 383-4328

San Diego & Riverside Districts
1350 Front Street, Room 2050
San Diego, CA 92101
Telephone: (619) 525-4159

Santa Ana District
28 Civic Center Plaza, Room 325

Santa Ana, CA 92701
Telephone: (714) 558-4410 California

Department of Toxic Substances Control

1001 I Street
P.O. Box 806
Sacramento, CA 95812-0806
Telephone: (916) 324-1826
Web: www.dtsc.ca.gov

DTSC issues permits for treatment, storage, and disposal of hazardous wastes; inspects facilities; maintains a Superfund list; and has a site cleanup program.

Northern California Regional Offices

Sacramento Office

8800 Cal Center Drive
Sacramento, CA 95826-3268
Telephone: (916) 255-3618

Clovis Office

1515 Tollhouse Road
Clovis, CA 93611-0522
Telephone: (559) 297-3901

Berkeley Office

700 Heinz Avenue, Suite #200
Berkeley, CA 94710-2721
Telephone: (510) 540-2122

Southern California Regional Offices

Chatsworth Office

9211 Oakdale Avenue
Chatsworth, CA 91311-6505
Phone: (818) 717-6500

Cypress Office

5796 Corporate Avenue
Cypress, CA 90630-4732
Telephone: (714) 484-5300

San Diego Office

9174 Skypark Court, Suite 150
San Diego, CA 92123
Telephone: (858) 637-5531

California Department of Housing and Community Development

Division of Administration - Manufactured Housing
1800 Third Street, Room 260

Residential Environmental Hazards Booklet

**Page 44 of 48
January 2011**

P.O. Box 31
Sacramento, CA 95814
Telephone: (916) 445-3338
Administration of codes and statutes relating to mobile homes. It also allocates grants and loans for low-income housing, house rehabilitation, and disaster relief.

California Department of Real Estate (DRE)

Fresno District Office
Department of Real Estate
2550 Mariposa, Room 3070
Fresno, CA 93721-2273
Telephone: (559) 445-6153

Oakland District Office
Department of Real Estate
1515 Clay Street, Room 702
Oakland, CA 94612-1462
Telephone: (510) 622-2552

Los Angeles Executive Office
Department of Real Estate
320 W. 4th Street, Suite 350
Los Angeles, CA 90013-1150
Telephone: (213) 620-2072

San Diego District Office
Department of Real Estate
1350 Front Street, Room 3064
San Diego, CA 92101-3687
Telephone: (619) 525-4375

Sacramento Principal Office
Department of Real Estate
2201 Broadway
P.O. Box 187000
Sacramento, CA 95818-7000
Telephone: (916) 227-0864
This unit provides information on lead toxicity and treatment of lead toxicity in children.

APPENDIX B Glossary

AERATION: A technique by which air is introduced into a liquid; bubbles and aerosols are generated and dissolved gases released. For example, water aerated by passing through a shower head will release dissolved radon gas.

ACTIVATED CARBON: A material made from burnt wood which is used to remove organic solutes, such as pesticides, and some inorganic solutes, such as chlorine, from water. Dissolved organic solutes are removed from the water by absorption onto the activated carbon. The activated carbon must be periodically replaced when it becomes saturated and unable to adsorb any more solute. Activated carbon is not effective in removing heavy metals, such as lead, and salts, which make water hard.

ANNUAL AVERAGE LEVEL: The average of measurements taken at different times over the period of one year or the level measured by a device left in place for a full year.

CARCINOGEN: A substance that causes cancer.

CATHODE RAY TUBE: The cathode ray tube, or CRT, is the display device used in most computer displays, video monitors, and televisions.

CERTIFIED LABORATORY: A laboratory that has demonstrated that it can meet the federal and state standards for accuracy and precision for a given analytical procedure.

DISTILLATION: As referenced in this booklet, distillation is a technique used to purify water by removal of inorganic contaminants such as salts through heating the solution and condensing the steam. The resultant distilled water has a reduced salt concentration. Distillation is not effective in removing pesticides and volatile organic contaminants such as chloroform and benzene.

EXPOSURE: Contact with an agent through inhalation, ingestion, or touching. For example, exposure to radon is primarily through inhalation; exposure to lead is primarily through ingestion.

FILTRATION: Purification of water by removing undissolved solids or sediment by passing the water through a filter or sieve. Filtration does not remove dissolved salts or organic contaminants.

FRIABLE: Easily crumbled, pulverized, or reduced to a powder by hand.

LEVEL: Another term for concentration; also, the amount of a substance in a given volume of air, liquid or solid.

LITER: Metric unit of volume equivalent to 1.057 quarts of liquid. One gallon is equivalent to about four liters.

MILLIGRAM: A unit of weight. There are 1,000 milligrams in one gram and about 28 grams in one ounce.

MITIGATION: Mitigation means any action taken to reduce or eliminate the risk to human health and the environment from hazardous waste.

PARTS PER MILLION: A unit of concentration. For example, air that contains 1 part per million formaldehyde contains 1.2 milligrams formaldehyde in 1 million milliliters air, i.e. 1,000 liters air. Also, water which contains 1 part per million lead contains 1 milligram lead in 1 million milligrams water, i.e., 1 kilogram water. One part per million can be compared to one cent in ten thousand dollars.

PASSIVE DETECTOR: A measuring device that functions without any energy input or ongoing attention from the user. For example, use of a passive radon detector to measure radon requires only that the detector be left in place for a specified time.

PICOCURIE: A unit of amount used in measurement of radioactive substances. For example, five picocuries of radon are five trillionths of a curie and are equivalent to 11 radioactive radon atoms decaying every minute.

RADIOACTIVE: A term used to describe atoms that are unstable and break down or decay to form another kind of atom. For example, radium breaks down to form radon. In the process of decay some high-energy particles are emitted. The detection of these particles by special instruments indicates that a substance is radioactive. The high-energy particles and gamma rays are called radiation.

REACTIVE: A solid waste that is normally unstable, reacts violently with water, or generates toxic gases when exposed to water or other materials.

REVERSE OSMOSIS: A technology used to purify water by removing the salts from water. Osmosis involves the diffusion of water from a dilute to a concentrated solution across a semi-permeable membrane that allows only the passage of water. In reverse osmosis, water is forced through a semi-permeable membrane from a concentrated solution to a stream of purified water. For example, in the desalination of seawater, reverse osmosis is used to separate the salts from the water generating drinking water and a residue of salts.

RISK: In the context of this booklet, risk indicates the chance of developing a disease after exposure to an environmental hazard. Risk depends on the time period for which a person is exposed to a particular hazard and the level of the hazard.

SOFT WATER: Water that does not contain large amounts of dissolved minerals such as salts containing calcium or magnesium.

SOLDER: A metallic compound used to seal joints between pipes. Until recently, most solder contained about 50 percent lead. Lead solder is now banned for plumbing applications.

TOXICITY: The extent to which a material is toxic.