

## **Appendix A: Glossary**

### **ATSDR Glossary of Terms**

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health. This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

#### **General Terms**

##### **Absorption**

The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

##### **Acute**

Occurring over a short time [compare with chronic].

##### **Acute exposure**

Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

##### **Additive effect**

A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

##### **Adverse health effect**

A change in body function or cell structure that might lead to disease or health problems

##### **Aerobic**

Requiring oxygen [compare with anaerobic].

##### **Ambient**

Surrounding (for example, ambient air).

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**Anaerobic**

Requiring the absence of oxygen [compare with aerobic].

**Analyte**

A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

**Analytic epidemiologic study**

A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

**Antagonistic effect**

A biologic response to exposure to multiple substances that is less than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

**Background level**

An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

**Biodegradation**

Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

**Biologic indicators of exposure study**

A study that uses (a) biomedical testing or (b) the measurement of a substance [an analyte], its metabolite, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see exposure investigation].

**Biologic monitoring**

Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

**Biologic uptake**

The transfer of substances from the environment to plants, animals, and humans.

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### **Biomedical testing**

Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

### **Biota**

Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

### **Body burden**

The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

### **CAP [see Community Assistance Panel.]**

### **Cancer**

Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

### **Cancer risk**

A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

### **Carcinogen**

A substance that causes cancer.

### **Case study**

A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

### **Case-control study**

A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

### **CAS registry number**

A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

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### **Central nervous system**

The part of the nervous system that consists of the brain and the spinal cord.

### **CERCLA [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]**

### **Chronic**

Occurring over a long time [compare with acute].

### **Chronic exposure**

Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

### **Cluster investigation**

A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

### **Community Assistance Panel (CAP)**

A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

### **Comparison value (CV)**

Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

### **Completed exposure pathway [see exposure pathway].**

### **Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)**

CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous

substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

### **Concentration**

The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

### **Contaminant**

A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

### **Delayed health effect**

A disease or an injury that happens as a result of exposures that might have occurred in the past.

### **Dermal**

Referring to the skin. For example, dermal absorption means passing through the skin.

### **Dermal contact**

Contact with (touching) the skin [see route of exposure].

### **Descriptive epidemiology**

The study of the amount and distribution of a disease in a specified population by person, place, and time.

### **Detection limit**

The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

### **Disease prevention**

Measures used to prevent a disease or reduce its severity.

### **Disease registry**

A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

### **DOD**

United States Department of Defense.

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## **DOE**

United States Department of Energy.

### **Dose (for chemicals that are not radioactive)**

The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

### **Dose (for radioactive chemicals)**

The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

### **Dose-response relationship**

The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

### **Environmental media**

Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

### **Environmental media and transport mechanism**

Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

## **EPA**

United States Environmental Protection Agency.

### **Epidemiologic surveillance [see Public health surveillance].**

### **Epidemiology**

The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

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## **Exposure**

Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

## **Exposure assessment**

The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

## **Exposure-dose reconstruction**

A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

## **Exposure investigation**

The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

## **Exposure pathway**

The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

## **Exposure registry**

A system of ongoing followup of people who have had documented environmental exposures.

## **Feasibility study**

A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

## **Geographic information system (GIS)**

A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

## **Grand rounds**

Training sessions for physicians and other health care providers about health topics.

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## **Groundwater**

Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

## **Half-life ( $t^{1/2}$ )**

The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

## **Hazard**

A source of potential harm from past, current, or future exposures.

## **Hazardous Substance Release and Health Effects Database (HazDat)**

The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

## **Hazardous waste**

Potentially harmful substances that have been released or discarded into the environment.

## **Health consultation**

A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

## **Health education**

Programs designed with a community to help it know about health risks and how to reduce these risks.

## **Health investigation**

The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical



measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

### **Health promotion**

The process of enabling people to increase control over, and to improve, their health.

### **Health statistics review**

The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

### **Indeterminate public health hazard**

The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

### **Incidence**

The number of new cases of disease in a defined population over a specific time period [contrast with prevalence].

### **Ingestion**

The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

### **Inhalation**

The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

### **Intermediate duration exposure**

Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

### **In vitro**

In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with in vivo].

### **In vivo**

Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with in vitro].

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### **Lowest-observed-adverse-effect level (LOAEL)**

The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

### **Medical monitoring**

A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

### **Metabolism**

The conversion or breakdown of a substance from one form to another by a living organism.

### **Metabolite**

Any product of metabolism.

### **mg/kg**

Milligram per kilogram.

### **mg/cm<sup>2</sup>**

Milligram per square centimeter (of a surface).

### **mg/m<sup>3</sup>**

Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

### **Migration**

Moving from one location to another.

### **Minimal risk level (MRL)**

An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

### **Morbidity**

State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

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**Mortality**

Death. Usually the cause (a specific disease, a condition, or an injury) is stated.

**Mutagen**

A substance that causes mutations (genetic damage).

**Mutation**

A change (damage) to the DNA, genes, or chromosomes of living organisms.

**National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)**

EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

**National Toxicology Program (NTP)**

Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

**No apparent public health hazard**

A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

**No-observed-adverse-effect level (NOAEL)**

The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

**No public health hazard**

A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

**NPL [see National Priorities List for Uncontrolled Hazardous Waste Sites]****Physiologically based pharmacokinetic model (PBPK model)**

A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

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**Pica**

A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

**Plume**

A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

**Point of exposure**

The place where someone can come into contact with a substance present in the environment [see exposure pathway].

**Population**

A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

**Potentially responsible party (PRP)**

A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

**ppb**

Parts per billion.

**ppm**

Parts per million.

**Prevalence**

The number of existing disease cases in a defined population during a specific time period [contrast with incidence].

**Prevalence survey**

The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

**Prevention**

Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

### **Public availability session**

An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

### **Public comment period**

An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

### **Public health action**

A list of steps to protect public health.

### **Public health advisory**

A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

### **Public health assessment (PHA)**

An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

### **Public health hazard**

A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

### **Public health hazard categories**

Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

### **Public health statement**

The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

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**Public health surveillance**

The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

**Public meeting**

A public forum with community members for communication about a site.

**Radioisotope**

An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

**Radionuclide**

Any radioactive isotope (form) of any element.

**RCRA [see Resource Conservation and Recovery Act (1976, 1984)]****Receptor population**

People who could come into contact with hazardous substances [see exposure pathway].

**Reference dose (RfD)**

An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

**Registry**

A systematic collection of information on persons exposed to a specific substance or having specific diseases [see exposure registry and disease registry].

**Remedial investigation**

The CERCLA process of determining the type and extent of hazardous material contamination at a site.

**Resource Conservation and Recovery Act (1976, 1984) (RCRA)**

This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

**RFA**

RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

**RfD [see reference dose]**

**Risk**

The probability that something will cause injury or harm.

**Risk reduction**

Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

**Risk communication**

The exchange of information to increase understanding of health risks.

**Route of exposure**

The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

**Safety factor [see uncertainty factor]**

**SARA [see Superfund Amendments and Reauthorization Act]**

**Sample**

A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

**Sample size**

The number of units chosen from a population or an environment.

**Solvent**

A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

**Source of contamination**

The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

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## **Special populations**

People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

## **Stakeholder**

A person, group, or community who has an interest in activities at a hazardous waste site.

## **Statistics**

A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

## **Substance**

A chemical.

## **Substance-specific applied research**

A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's toxicological profiles. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

## **Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)]**

### **Superfund Amendments and Reauthorization Act (SARA)**

In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

## **Surface water**

Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

## **Surveillance [see public health surveillance]**



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## **Survey**

A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

## **Synergistic effect**

A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

## **Teratogen**

A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

## **Toxic agent**

Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

## **Toxicological profile**

An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

## **Toxicology**

The study of the harmful effects of substances on humans or animals.

## **Tumor**

An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

## **Uncertainty factor**

Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have

some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

### **Urgent public health hazard**

A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

### **Volatile organic compounds (VOCs)**

Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

### **Other glossaries and dictionaries:**

Environmental Protection Agency (<http://www.epa.gov/OCEPATERMS/>)

**National Center for Environmental Health (CDC)**  
(<http://www.cdc.gov/nceh/dls/report/glossary.htm>)

**National Library of Medicine (NIH)**  
(<http://www.nlm.nih.gov/medlineplus/mplusdictionary.html>)

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## **Appendix B. ATSDR's Assessment Methodology and Comparison Values**

### **Human Exposure Pathway Evaluation and the Use of ATSDR Comparison Values**

The Agency for Toxic Substances and Disease Registry (ATSDR) assesses a site by evaluating the level of exposure in potential or completed exposure pathways. An exposure pathway is the way chemicals may enter a person's body to cause a health effect. It includes all the steps between the release of a chemical and the population exposed, including: (1) a chemical release source, (2) chemical movement, (3) a place where people can come into contact with the chemical, (4) a route of human exposure, and (5) a population that could be exposed. In this assessment, ATSDR evaluates chemicals in environmental media that people residing near a site may consume, inhale, or contact.

Health assessors use comparison values (CVs) as screening tools to evaluate environmental data that is relevant to the exposure pathways. CVs represent media-specific contaminant concentrations that are used to select contaminants for further evaluation to determine the possibility of adverse health effects. CVs used in this document include ATSDR's environmental media evaluation guide (EMEG) and cancer risk evaluation guide (CREG). CVs are derived from available health guidelines, such as ATSDR's minimal risk levels (MRL) and EPA's cancer slope factor (CSF).

CVs and health guidelines used in this public health assessment are described below:

#### **Cancer Effect Level (CEL)**

The CEL is the lowest dose of a chemical in a study, or group of studies, that was found to produce increased incidences of cancer (or tumors).

#### **Cancer Slope Factor (CSF)**

Usually derived from dose-response models and expressed in mg/kg/day, CSFs describe the inherent potency of carcinogens and estimate an upper limit on the likelihood that lifetime exposure to a particular chemical could lead to excess cancer deaths.

#### **Cancer Risk Evaluation Guide (CREG)**

Estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million ( $10^{-6}$ ) persons exposed over a 70-year life span. ATSDR's CREGs are calculated from EPA's cancer potency factors.

#### **EPA Region III Risk-Based Concentration (RBC)**

EPA combines reference doses and carcinogenic potency slopes with "standard" exposure scenarios to calculate risk-based concentrations, which are chemical concentrations corresponding to fixed levels of risk (i.e., a hazard quotient of 1, or lifetime cancer risk of  $10^{-6}$ , whichever occurs at a lower concentration) in water, air, fish tissue, and soil.

## **Environmental Media Evaluation Guide (EMEG)**

EMEGs are based on ATSDR minimal risk levels (MRLs) and factor in body weight and ingestion rates. An EMEG is an estimate of daily human exposure to a chemical (in mg/kg/day) that is likely to be without noncarcinogenic health effects over a specified duration of exposure to include acute, intermediate, and chronic exposures.

## **Lowest Observed Adverse Effect Level (LOAEL)**

The lowest dose of a chemical that produced an adverse-effect when it was administered to animals in a toxicity study.

## **Maximum Contaminant Level (MCL)**

The MCL is the drinking water stand established by EPA. It is the maximum permissible level of a contaminant in water that is delivered to a free-flowing outlet. MCLs are considered protective of human health over a lifetime (70 years) for individuals consuming 2 liters of water per day.

## **Minimal Risk Levels (MRL)**

MRLs are estimates of daily human exposure to a chemical (i.e., doses expressed in mg/kg/day) that are unlikely to be associated with any appreciable risk of deleterious noncancer effects over a specified duration of exposure. MRLs are calculated using data from human and animal studies and are reported for acute (< 14 days), intermediate (15-364 days), and chronic (> 365 days) exposures. MRLs are published in ATSDR Toxicological Profiles for specific chemicals.

## **Reference Media Evaluation Guide (RMEG)**

A concentration in air, soil, or water below which non-cancer health effects are not expected to occur. RMEGs are derived from EPA's Reference Dose or Reference Concentration, and are for chronic exposures. The derivation of a CV uses conservative exposure assumptions, resulting in values that are much lower than exposure concentrations observed to cause adverse health effects; thus, insuring the CVs are protective of public health in essentially all exposure situations. That is, if the concentrations in the exposure medium are less than the CV, the exposures are not of health concern and no further analysis of the pathway is required. However, while concentrations below the CV are not expected to lead to any observable health effect, it should not be inferred that a concentration greater than the CV will necessarily lead to adverse effects. Depending on site-specific environmental exposure factors (for example, duration of exposure) and activities of people that result in exposure (time spent in area of contamination), exposure to levels above the CV may or may not lead to a health effect. Therefore, ATSDR's CVs are not used to predict the occurrence of adverse health effects.

The CVs used in this evaluation are defined as follows: The CREG is a concentration at which excess cancer risk is not likely to exceed one case of cancer in a million persons exposed over a lifetime. The CREG is a very conservative CV that is used to estimate cancer risk. Exposure to a concentration equal to or less than the CREG is defined as an insignificant risk and is an

acceptable level of exposure over a lifetime. The risk from exposure is not considered as a significant risk unless the exposure concentration is approximately 10 times the CREG and exposure occurs over several years. The EMEG is a concentration at which daily exposure for a lifetime is unlikely to result in adverse noncancerous effects.

### **Elements of a Completed Exposure Pathway**

In evaluating public health hazards, ATSDR first tries to determine exposure in the past, present, and future. ATSDR does this by carefully evaluating the elements of an exposure pathway that might lead to human exposure. These elements include: (1) a source of site-related contamination, such as drums or waste pits; (2) an environmental medium in which the contaminants might be present or from which they might migrate, such as groundwater or soil; (3) points of human exposure, such as drinking water wells or gardens; (4) routes of exposure, such as breathing, eating, drinking, or touching a substance containing the contaminant; and (5) a receptor population. (Figure 4 explains the exposure pathway evaluation in more detail.) ATSDR then identifies an exposure pathway as completed or potential, or eliminates that pathway from further evaluation. A completed exposure pathway exists in the past, present, or future if all elements of human exposure link the contaminant source to a receptor population. A potential pathway is one that ATSDR cannot rule out, even though we cannot find one of the necessary elements.

If a completed or potential exposure pathway exists, ATSDR then considers whether any chemicals were present, are present, or are expected to become present.

### **Selecting Chemicals for Further Evaluation**

Identifying chemicals for further evaluation is a process that requires ATSDR to examine contaminant concentrations at the site, the quality of environmental sampling data, and the potential for human exposure. A thorough review of each of these issues is required to accurately select chemicals in the site-specific human exposure pathway. The following text describes the selection process.

In the first step of the chemical selection process, the maximum contaminant concentrations are compared directly to health-based CVs. ATSDR considers site-specific exposure factors to ensure selection of appropriate health CVs. If the maximum concentration reported for a chemical is less than the health CV, ATSDR concludes that exposure to that chemical is not of public health concern; therefore, no further data review is required for that chemical. However, if the maximum concentration is greater than the health CV, the chemical is selected for additional data review. In addition, any chemicals detected that do not have relevant health CVs are also selected for additional data review.

CVs have not been developed for some contaminants, and, based on new scientific information other CVs may be determined to be inappropriate for the specific type of exposure. In those cases, the contaminants are included for further review if current scientific information indicates exposure to those contaminants may be of public health concern.

The next step of the process requires a more in-depth review of data for each of the contaminants selected. Factors used in the selection of the chemicals includes the number of samples with detections above the minimum detection limit, the number of samples with detections above an acute or chronic health CV, and the potential for exposure at the monitoring location. If a contaminant exceeds the CV, an exposure dose is calculated. The following equation was used to estimate exposure doses:

$$\text{Estimated exposure dose} = \frac{\text{Conc.} \times \text{IR}}{\text{BW}} \text{ milligrams per kilograms per day (mg/kg/day)}$$

where:

Conc.: Concentration of chemical in milligrams per kilogram (mg/kg)

IR: Ingestion rate in kilograms per day (kg/day)

BW: Body weight in kilograms: adult = 70 kg; child = 16 kg

## **Appendix C: A Guide to Healthy Eating of the Fish You Catch**

# Introduction

**F**ish are an important part of a healthy diet. They are a lean, low-calorie source of protein. Some sport fish caught in the nation's lakes, rivers, oceans, and estuaries, however, may contain chemicals that could pose health risks if these fish are eaten in large amounts.

The purpose of this brochure is not to discourage you from eating fish. It is intended as a guide to help you select and prepare fish that are low in chemical pollutants. By following these recommendations, you and your family can continue to enjoy the benefits of eating fish.

Fish taken from polluted waters might be hazardous to your health. Eating fish containing chemical pollutants may cause birth defects, liver damage, cancer, and other serious health problems.

Chemical pollutants in water come from many sources. They come from factories and sewage treatment plants that you can easily see. They also come from sources that you can't easily see, like chemical spills or runoff from city streets and farm fields. Pollutants are also carried long distances in the air.

Fish may be exposed to chemical pollutants in the water, and the food they eat. They may take up some of the pollutants into their bodies. The pollutants are found in the skin, fat, internal organs, and sometimes muscle tissue of the fish.

## What can I do to reduce my health risks from eating fish containing chemical pollutants?

Following these steps can reduce your health risks from eating fish containing chemical pollutants. The rest of the brochure explains these recommendations in more detail.

1. **Call your local or state environmental health department.** Contact them before you fish to see if any advisories are posted in areas where you want to fish.
2. **Select certain kinds and sizes of fish for eating.** Younger fish contain fewer pollutants than older, larger fish. Panfish feed on insects and are less likely to build up pollutants.
3. **Clean and cook your fish properly.** Proper cleaning and cooking techniques may reduce the levels of some chemical pollutants in the fish.



### Health Note

Advisories are different from fishing restrictions or bans or limits. Advisories are issued to provide **recommendations** for limiting the amount of fish to be eaten due to levels of pollutants in the fish.

## A Message from the Administrator

Christine Todd Whitman



I believe water is the biggest environmental issue we face in the 21<sup>st</sup> Century in terms of both quality and quantity. In the 30 years since its passage, the Clean Water Act has dramatically increased the number of waterways that are once again safe for fishing and swimming. Despite this great progress in reducing water pollution, many of the nation's waters still do not meet water quality goals. I challenge you to join with me to finish the business of restoring and protecting our nation's waters for present and future generations.

## For More Information

For more information about reducing your health risks from eating fish that contain chemical pollutants, contact your local or state health or environmental protection department. You can find the telephone number in the blue section of your local telephone directory.

You may also contact:

U.S. Environmental Protection Agency  
Office of Water  
Fish and Wildlife Contamination Program (4305T)  
1200 Pennsylvania Avenue, NW  
Washington, DC 20460

web address: [www.epa.gov/ost/fish](http://www.epa.gov/ost/fish)

United States Environmental Protection Agency  
Office of Water (4101M)  
EPA 823-F-02-005 • April 2002



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In celebration of the 30th anniversary of the Clean Water Act, EPA presents

# A Guide to Healthy Eating of the Fish You Catch



★ 2002 ★  
THE YEAR OF  
CLEAN WATER

*Celebration + Commitment*



Developed in collaboration with the Agency for Toxic Substances and Disease Registry, U.S. Public Health Service



# Catching Fish

## How can I find out if the waters that I fish in are polluted?

It's almost impossible to tell if a water body is polluted simply by looking at it. However, there are ways to find out.

First, look to see if warning signs are posted along the water's edge. If there are signs, follow the advice printed on them.

Second, even if you don't see warning signs, call your local or state health or environmental protection department and ask for their advice. Ask them if there are any advisories on the kinds or sizes of fish that may be eaten from the waters where you plan to fish. You can also ask about fishing advisories at local sporting goods or bait shops where fishing licenses are sold.



If the water body has not been tested, follow these guidelines to reduce your health risks from eating fish that might contain small amounts of chemical pollutants.



### Health Note

Some chemical pollutants, such as mercury and PCBs, can pose greater risks to women of childbearing age, pregnant women, nursing mothers, and young children. This group should be especially careful to greatly reduce or avoid eating fish caught from polluted waters.

## Do some fish contain more pollutants than others?

Yes. You can't look at fish and tell if they contain chemical pollutants. The only way to tell if fish contain harmful levels of chemical pollutants is to have them tested in a laboratory. Follow these simple guidelines to lower the risk to your family:

- If you eat gamefish, such as lake trout, salmon, walleye, and bass, eat the smaller, younger fish (within legal limits). They are less likely to contain harmful levels of pollutants than larger, older fish.
- Eat panfish, such as bluegill, perch, stream trout, and smelt. They feed on insects and other aquatic life and are less likely to contain high levels of harmful pollutants.
- Eat fewer fatty fish, such as lake trout, or fish that feed on the bottoms of lakes and streams such as catfish and carp. These fish are more likely to contain higher levels of chemical pollutants.

## Cleaning Fish

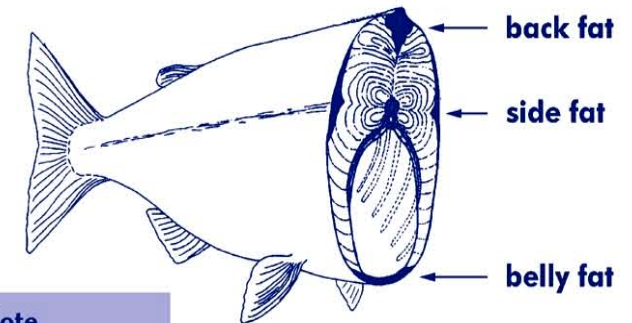
### Can I clean my fish to reduce the amount of chemical pollutants that might be present?

Yes. It's always a good idea to remove the skin, fat, and internal organs (where harmful pollutants are most likely to accumulate) before you cook the fish.

As an added precaution:

- Remove and throw away the head, guts, kidneys, and the liver.

Trim away the skin and fatty tissue before cooking to reduce the level of some pollutants in the fish you eat.



### Health Note

Mercury is found throughout the tissue in fish, so these cleaning and cooking techniques will not reduce the amount of mercury in a meal of fish.

- Fillet fish and cut away the fat and skin before you cook it.
- Clean and dress fish as soon as possible.

Remember that with any fresh meat, always follow proper food handling and storage techniques. To prevent the growth of bacteria or viruses, keep freshly caught fish on ice and out of direct sunlight.

## Cooking Fish

### Can I cook my fish to reduce my health risk from eating fish containing chemical pollutants?

Yes. The way you cook fish can make a difference in the kinds and amounts of chemical pollutants remain-

ing in the fish. Fish should be properly prepared and grilled, baked, or broiled. By letting the fat drain away, you can remove pollutants stored in the fatty parts of the fish. Added precautions include:

- Avoid or reduce the amount of fish drippings or broth that you use to flavor the meal. These drippings may contain higher levels of pollutants.
- Eat less fried or deep fat-fried fish because frying seals any chemical pollutants that might be in the fish's fat into the portion that you will eat.
- If you like smoked fish, it is best to fillet the fish and remove the skin before the fish is smoked.

