

## **APPENDIX B**



Photograph 1: Broken bricks and glass on the Standard Chlorine site



Photograph 2: Example of dilapidated building on the Standard Chlorine site



Photograph 3: The former distillation building in the lagoon system area



Photograph 4: The lagoon system



Photograph 5: Trench with standing water located inside the fenced area surrounding the lagoon system



Photograph 6: The southern drainage ditch



Photograph 7: Sea boxes containing dioxin-contaminated asbestos among other process wastes



Photograph 8: The office building on the western portion of the Standard Chlorine site



Photograph 9: Entrance to the Standard Chlorine site



Photograph 10: Example of broken windows on the Standard Chlorine site



Photograph 11: The north outfall adjacent to the former Diamond Shamrock site



Photograph 12: Trailer storage on the former Diamond Shamrock property



Photograph 13: Storm drain located on the driveway shared between Standard Chlorine and the former Diamond Shamrock site



Photograph 14: Standing water as observed in the shared driveway



## **APPENDIX C**

## Toxicological Characteristics of Chemicals of Concern

The toxicological summaries provided below are based on ATSDR's ToxFAQs (<http://www.atsdr.cdc.gov/toxfaq.html>) and the NJDHSS Right to Know Program (<http://www.state.nj.us/health/eoh/rtkweb/rtkhsfs.htm#D>). Health effects are summarized in this section for some of the chemicals of concern found most frequently above CVs in the Hackensack River surface water and sediment.

The health effects described in the toxicological summaries are typically known to occur at levels of exposure much higher than those that occur from environmental contamination. The chance that a health effect will occur is dependent on the amount, frequency and duration of exposure, and the individual susceptibility of exposed persons.

### Chromium

Chromium is a naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases. Chromium is present in the environment in several different forms, which are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds. The metal chromium, which is the chromium(0) form, is used for making steel. Chromium(VI) and chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

Chromium enters the air, water, and soil mostly in the chromium(III) and chromium(VI) forms. In air, chromium compounds are present mostly as fine dust particles which eventually settle over land and water. Chromium can strongly attach to soil and only a small amount can dissolve in water and move deeper in the soil to underground water. Fish do not accumulate much chromium in their bodies from water.

Breathing high levels of chromium(VI) can cause irritation to the nose, such as runny nose, nosebleeds, and ulcers and holes in the nasal septum. Ingesting large amounts of chromium(VI) can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death. Skin contact with certain chromium(VI) compounds can cause skin ulcers. Allergic reactions consisting of severe redness and swelling of the skin have been noted.

Several studies have shown that chromium(VI) compounds can increase the risk of lung cancer. Animal studies have also shown an increased risk of cancer. The World Health Organization (WHO) has determined that chromium(VI) is a human carcinogen. The US Department of Health and Human Services (DHHS) has determined that certain chromium(VI) compounds are known to cause cancer in humans. The EPA has determined that chromium(VI) in air is a human carcinogen.

It is unknown if exposure to chromium will result in birth defects or other developmental effects in people. Birth defects have been observed in animals exposed to chromium(VI). It is likely that health effects seen in children exposed to high amounts of chromium will be similar to the effects seen in adults.

### 1,2-Dichlorobenzene

1,2-Dichlorobenzene is a colorless to pale yellow liquid with a pleasant odor. It is used as a fumigant, solvent, chemical intermediate, and insecticide.

1,2-Dichlorobenzene can affect you when breathed in and by passing through your skin. Contact can irritate and burn the skin and eyes. Skin allergy may develop. Exposure can cause headache, nausea, and irritation of the nose and throat. Higher exposure can cause you to become dizzy and lightheaded and to pass out. Long-term exposure may damage the blood cells. 1,2-Dichlorobenzene may damage the liver, kidneys and lungs, and affect the nervous system. This chemical has not been adequately evaluated to determine whether brain or other nerve damage could occur with repeated exposure. However, many solvents and other petroleum-based chemicals have been shown to cause such damage. Effects may include reduced memory and concentration, personality changes (withdrawal, irritability), fatigue, sleep disturbances, reduced coordination, and/or effects on nerves supplying internal organs (autonomic nerves) and/or nerves to the arms and legs (weakness, "pins and needles").

There is a suggested association between exposure to 1,2-Dichlorobenzene and leukemia. According to the information presently available to the New Jersey Department of Health and Senior Services, 1,2-Dichlorobenzene has been tested and has not been shown to affect reproduction.

### 1,3-Dichlorobenzene

1,3-Dichlorobenzene is a colorless liquid. It is used as a fumigant, an insecticide, and as a chemical intermediate. Acute (short-term) health effects may occur immediately or shortly after exposure to 1,3-Dichlorobenzene. Breathing 1,3-Dichlorobenzene can irritate the nose and throat causing coughing and wheezing. Contact can cause skin and eye irritation and burns. Exposure to 1,3-Dichlorobenzene can cause headache, drowsiness, nausea, vomiting diarrhea and abdominal cramps. 1,3-Dichlorobenzene may damage the red blood cells leading to low blood count (anemia). Chronic (long-term) health effects can occur at some time after exposure to 1,3-Dichlorobenzene and can last for months or years. There is no evidence that 1,3-Dichlorobenzene causes cancer in animals. This is based on test results presently available to the New Jersey Department of Health and Senior Services from published studies. According to the information presently available to the New Jersey Department of Health and Senior Services, 1,3-Dichlorobenzene has not been tested for its ability to affect reproduction. Other chronic effects include skin allergies. If an allergy develops, very low future exposure can cause itching and a skin rash. 1,3-Dichlorobenzene may affect the liver and kidneys.

### 1,4-Dichlorobenzene

1,4-Dichlorobenzene is a chemical used to control moths, molds, and mildew, and to deodorize restrooms and waste containers. It is also called para-DCB or p-DCB. Other

names include Paramoth, Para crystals, and Paracide reflecting its widespread use to kill moths. At room temperature, p-DCB is a white solid with a strong, pungent odor. When exposed to air, it slowly changes from a solid to a vapor. Most p-DCB in our environment comes from its use in moth repellent products and in toilet deodorizer blocks.

In air, it breaks down to harmless products in about a month. It does not dissolve easily in water. It is not easily broken down by soil organisms. It evaporates easily from water and soil, so most is found in the air. It is taken up and retained by plants and fish.

There is no evidence that moderate use of common household products that contain p-DCB will result in harmful effects to your health. Harmful effects, however, may occur from high exposures. Very high usage of p-DCB products in the home can result in dizziness, headaches, and liver problems. Some of the patients who developed these symptoms had been using the products for months or even years after they first began to feel ill.

Workers breathing high levels of p-DCB (1,000 times more than levels in deodorized rooms) have reported painful irritation of the nose and eyes. There are cases of people who have eaten p-DCB products regularly for months to years because of its sweet taste. These people had skin blotches and lower numbers of red blood cells.

The US Department of Health and Human Services (DHHS) has determined that p-DCB may reasonably be anticipated to be a carcinogen. There is no direct evidence that p-DCB can cause cancer in humans. However, animals given very high levels in water developed liver and kidney tumors.

There is very little information on how children react to p-DCB exposure, but children would probably show the same effects as adults. No studies in people or animals show that p-DCB crosses the placenta or can be found in fetal tissues. Based on other similar chemicals, it is possible that this could occur. There is no credible evidence that p-DCB causes birth defects. One study found dichlorobenzenes in breast milk, but p-DCB has not been specifically measured.

### 1,2,4-Trichlorobenzene

1,2,4-Trichlorobenzene is a colorless liquid with a pleasant odor. It is used in heat transfer fluids, as a dielectric fluid, and in making chemicals, insecticides and fungicides. Breathing 1,2,4-Trichlorobenzene can irritate the nose, throat and eyes. Acute (short-term) health effects may occur immediately or shortly after exposure to 1,2,4-Trichlorobenzene: Contact can irritate the skin. Prolonged contact may cause skin burns. Chronic (long-term) health effects can occur at some time after exposure to 1,2,4-Trichlorobenzene and can last for months or years. Repeated exposure may damage the liver and kidneys. According to the information presently available to the New Jersey Department of Health and Senior Services, 1,2,4-Trichlorobenzene has been tested and has not been shown to cause cancer in animals. 1,2,4-Trichlorobenzene has been tested

and has not been shown to affect reproduction based on information presently available to the New Jersey Department of Health and Senior Services.

### Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot. These include benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, phenanthrene, and naphthalene

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people. Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

The US Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens. Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

### 2,3,7,8-TCDD (Dioxin)

2,3,7,8-TCDD belongs to a family of 75 chemically related compounds commonly known as chlorinated dioxins (CDD). It is one of the most toxic of the CDDs and is the one most studied. 2,3,7,8-TCDD is odorless and the odors of the other CDDs are not known.

2,3,7,8-TCDD may be formed during the chlorine bleaching process at pulp and paper mills. CDDs are also formed during chlorination by waste and drinking water treatment plants. They can occur as contaminants in the manufacture of certain organic chemicals. CDDs are released into the air in emissions from municipal solid waste and industrial incinerators.

When released into the air, some CDDs may be transported long distances, even around the globe. CDD concentrations may build up in the food chain, resulting in

measurable levels in animals. Eating food, primarily meat, dairy products, and fish, makes up more than 90% of the intake of CDDs for the general population.

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, discoloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people.

In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure. In many species of animals, 2,3,7,8-TCDD weakens the immune system and causes a decrease in the system's ability to fight bacteria and viruses. In other animal studies, exposure to 2,3,7,8-TCDD has caused reproductive damage and birth defects. The offspring of animals exposed to 2,3,7,8-TCDD during pregnancy often had severe birth defects including skeletal deformities, kidney defects, and weakened immune responses.

Several studies suggest that exposure to 2,3,7,8-TCDD increases the risk of several types of cancer in people. Animal studies have also shown an increased risk of cancer from exposure to 2,3,7,8-TCDD. The World Health Organization (WHO) has determined that 2,3,7,8-TCDD is a human carcinogen. The US Department of Health and Human Services (DHHS) has determined that 2,3,7,8-TCDD may reasonably be anticipated to cause cancer. Very few studies have looked at the effects of CDDs on children. Chloracne has been seen in children exposed to high levels of CDDs. It is not known that CDDs affect the ability of people to have children or if it causes birth defects, but given the effects observed in animal studies, this cannot be ruled out.

### PCB – Arochlor 1260

Polychlorinated biphenyls (PCBs) are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the US by the trade name Arochlor. PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators.

PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have

shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs. Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The US Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The USEPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported. In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

## **APPENDIX D**



## **Summary of Public Comments and Responses Standard Chlorine Chemical Company, Inc. Public Health Assessment**

This summary presents the comments received from interested parties on the Public Comment Draft of the Standard Chlorine Chemical Company, Inc. Public Health Assessment, and the subsequent responses of the NJDHSS and the ATSDR. The public comment period occurred from September 30 through November 13, 2004. Comments are grouped by Commenter, without personal identifiers. Note that page numbers in the comments and responses refer to the Public Comment Draft of the Public Health Assessment.

We are grateful to the two interested parties who provided their review and input on the draft Public Health Assessment. Where appropriate, the report was amended to address their comments and concerns.

### **Commenter A**

Comment 1: *“Specifically, our disagreement arises as follows: “Indeterminate Public Health Hazard” for the biota pathway ... we feel that there is sufficient evidence to consider the site a “Public Health Hazard” for the Biota Pathway.”*

Response 1: Although this site is a contributor to dioxin contamination of the Hackensack River, other regional sources have contributed to the dioxin contamination of the Newark Bay Complex, which includes the Hackensack River. As such, a reliable assessment of a particular site’s contribution of contamination is difficult. Additional contaminant data for the Hackensack River relating to dioxin and other chlorinated organics are expected to be available shortly from the NJDEP. This information may provide an approximate estimate of the Standard Chlorine site’s contribution of dioxin contamination to biota.

Comment 2: *““No Apparent Public Health Hazard” for all other pathways: The pathway for air exposure was ruled out based on the fact that there is no residential population within 1 mile of the site ... we ask that the potential public health hazard from the air pathway be re-evaluated.”*

Response 2: We further discussed this comment with the NJDEP and a statement recommending air monitoring to evaluate impacts from site-related contaminants has been added as a separate recommendation to the final Public Health Assessment.

At the present time no residential population exists within a one-mile radius of the site, although there are residential communities beyond the one-mile radius. However, the NJDHSS agrees that the potential exists for future exposures to occur based upon planned area redevelopment. As such, the pathway classification for ambient air has been changed from eliminated to potential; the Public Health Hazard Category recommended for this pathway is *“Indeterminate Public Health Hazard”*.

Comment 3: *“Technical details: - Tables 2, 4, and 5 each indicate a concentration that exceeds 1,000,000 mg/kg for an individual pollutant. This is not possible.”*

Response 3: The NJDHSS acknowledges the above statement. The draft Public Health Assessment provided the analytical results as reported in the Remedial Investigation (Weston 1993).

### **Commenter B**

Comment 1a: *“The Assessment is woefully inadequate and potentially misleading without additional data collection and information on how data was compiled and averaged ...”*

Response 1a: For the purpose of the draft Public Health Assessment, the NJDHSS obtained, organized, reviewed and evaluated environmental sampling data available from the responsible state and federal environmental agencies. A detailed explanation of this effort is provided in the Environmental Contamination section located on page 9 of the draft Public Health Assessment. Additionally, there are eight data tables provided in the report (Appendix A) which provide a chronological, media-specific description of both on- and off-site contamination.

Comment 1b: *“... dispersion modeling of volatile contaminants ... is necessary to determine the full extent of possible human exposure.”*

Response 1b: Currently, there are no individuals residing within a one-mile radius of the site, and air dispersion modeling was not conducted as part of the draft Public Health Assessment. On page 22 of the draft Public Health Assessment, the NJDHSS recommended that air monitoring data be collected during site remedial activities to determine the potential health impact of airborne contaminants to on- and off-site worker populations. Future air data, when available, will be evaluated in a separate Health Consultation. Additionally, a recommendation regarding air monitoring to evaluate impacts from site-related contaminants has been added to the final Public Health Assessment.

Comment 1c: *“... the south drainage ditch contains a brownish-white substance that should be characterized. An analysis of its fate and transport needs to be conducted.”*

Response 1c: Migration pathways from on- to off-site areas are discussed beginning on page 17 of the draft Public Health Assessment. This section includes an extensive description of the south drainage ditch and fate/transport to the Hackensack River.

Comment 1d: *“... the report does not contain any hydrological studies which evaluate groundwater and surface water movement associated with the site.”*

Response 1d: Please refer to Recommendation 2 located on page 22 of the draft Public Health Assessment. The NJDHSS concurs that hydrogeological studies are needed to characterize the direction and extent of contaminant migration from the site to off-site areas.

Comment 2: *“The Assessment fails to properly address the community health concerns.”*

Response 2: Please refer to the “Community Concerns” section located on page 8 of the draft Public Health Assessment. According to the local health department, USEPA, and NJDEP, no community concerns were reported for the site. The NJDHSS also searched and reviewed local news articles in an effort to identify community concerns. The focus of the majority of the articles was on remedial measures and the controversy over the possible addition of the site to the National Priorities List.

Prior to the submission of the draft Public Health Assessment for public comment release, staff of the NJDHSS and ATSDR conducted a second site visit. Information obtained during this site visit, which expanded our knowledge of community health concerns and potential human exposure pathways, has been incorporated into the Site Visit section of the final Public Health Assessment.

Comment 3: *“The Assessment is incomplete in its analysis of recreational uses of the Hackensack River ... Finally, although there are only two fishing locations identified by the Assessment, there are a number of other popular fishing locations ...”*

Response 3: Although recreational use of the river may be year-long with large populations involved depending on the season of year, individual exposures from this pathway are not continuous and vary by personal activity. Please note that the biota pathway in the draft Public Health Assessment was identified as a significant exposure pathway associated with the site.

Comment 4: *“The Assessment’s analysis of the pathway exposure for anglers is incomplete.”*

Response 4: Considerable effort has been made by a number of state agencies in determining potential health risks to New Jersey anglers. Beginning on page 17 of the draft Public Health Assessment, the NJDEP Routine Monitoring Program for Toxics in Fish was discussed. This Program includes an education and outreach effort by the NJDEP, the Department of Agriculture and the NJDHSS via public hearings. Questions and answers recorded at these hearings may be viewed at [www.state.nj.us/dep/dsr/response-budget](http://www.state.nj.us/dep/dsr/response-budget). Discussions with regional angler communities are planned by the NJDEP to present available education and outreach information and, more importantly, identify locations where fishing for consumption regularly takes place despite posted fish consumption advisories.

The most recent NJDEP angler survey conducted of the Newark Bay Complex occurred in 1995 and included questions on the preparation of fish and crabs for

consumption. Results indicated that most recreational anglers who reported eating fish and crabs prepared their catch according to fish consumption advisories, although some anglers reported not adhering to guidelines when preparing fish and crabs for soups and sauces. Pilot projects, in conjunction with additional angler surveys, are being planned to identify effective means of communicating advisories, fishing bans, and health risks associated with fish and shellfish obtained from the Newark and Raritan Bays, and the Hackensack and Passaic Rivers (K. Kirk-Pflugh, NJDEP, personal communication, 2004).

The above information has been incorporated into the Public Health Actions Planned section of the final Public Health Assessment.

Comment 5: “... *the Assessment must address current and future pathways for exposure* ...”

Response 5: Please refer to Recommendations 3 and 4 on page 22 of the draft Public Health Assessment.

Comment 6: “... *migration of on-site contaminants to the Hackensack River must stop immediately.*”

Response 6: The NJDHSS has recommended that the USEPA reduce the migration of on-site contaminants to the Hackensack River (see Recommendation 1 on page 21 of the draft Public Health Assessment).

## **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).

#### **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.

**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.

**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.

**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.

**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.

**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].

**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.

**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.

**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.

**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.

**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]

**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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