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## 1 **D. Appendix D: Definitions of Comparison Values**

2 Following are definitions of the various health-based comparison values that ATSDR used in this  
3 PHA to put the measured and modeled levels of environmental contamination into perspective:

4 CREG: Cancer Risk Evaluation Guide, a highly conservative and theoretical value that is  
5 believed to cause no more than one excess cancer in a million persons exposed over time.

6 DCG: Derived Concentration Guide, radionuclide exposure level reported by DOE that would  
7 deliver (for inhalation pathways) an annual effective dose equivalent of 100 millirem/year to an  
8 individual who is continuously exposed 24 hours per day, 365 days per year. DOE has also  
9 calculated DCGs for ingestion exposures.

10 EMEG: Environmental Media Evaluation Guide, a media-specific comparison value that  
11 is used to select contaminants of concern. Levels below the EMEG are not expected to cause  
12 adverse noncarcinogenic health effects. These have been developed for acute exposure scenarios,  
13 intermediate exposure scenarios, and chronic exposure scenarios.

14 MRL: Minimal Risk Level, an estimate of daily human exposure to a dose of a chemical  
15 that is likely to be without an appreciable risk of adverse non-cancerous effects over a specified  
16 duration of exposure.

17 NAAQS: National Ambient Air Quality Standard, an ambient air concentration that EPA  
18 has established to characterize air quality. The standards are health-based and were designed to  
19 be protective of many sensitive populations, such as people with asthma and children. The  
20 standards have been developed only for a small subset of pollutants, and their averaging times  
21 and statistical interpretations vary among the regulated pollutants.

22 RBC: Risk-Based Concentration, a contaminant concentration that is not expected to  
23 cause adverse health effects over long-term exposure. These have been developed for both  
24 cancer outcomes (RBC-C) and non-cancer outcomes (RBC-N).

25 RfC: Reference Concentration, an ambient air concentration developed by EPA that  
26 people, including sensitive subpopulations, likely can be exposed to continuously over a lifetime  
27 without developing adverse non-cancer health effects. RfCs typically have uncertainty factors  
28 built into them to account for any perceived limitations in the data on which they are based.

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## 1 **E. Appendix E: ATSDR Glossary of Terms**

2 The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health  
3 agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States.  
4 ATSDR's mission is to serve the public by using the best science, taking responsive public  
5 health actions, and providing trusted health information to prevent harmful exposures and  
6 diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S.  
7 Environmental Protection Agency (EPA), which is the federal agency that develops and enforces  
8 environmental laws to protect the environment and human health.

9 This glossary defines words used by ATSDR in this PHA. It is not a complete dictionary of  
10 environmental health terms. If you have questions or comments, call ATSDR's toll-free  
11 telephone number, 1-888-42-ATSDR (1-888-422-8737).

### 12 **Acute**

13 Occurring over a short time [compare with **chronic**].

### 14 **Acute exposure**

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

### 17 **Adverse health effect**

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

### 19 **Ambient**

20 Surrounding (for example, *ambient* air).

### 21 **Background level**

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

### 24 **Background radiation**

25 The amount of radiation to which a member of the general population is exposed from natural  
26 sources, such as terrestrial radiation from naturally occurring **radionuclides** in the soil, cosmic  
27 radiation originating from outer space, and naturally occurring radionuclides deposited in the  
28 human body.

### 29 **Biota**

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

**1 Cancer**

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

**4 Cancer risk**

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

**7 Carcinogen**

8 A substance that causes cancer.

**9 Case-control study**

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

**13 CERCLA**

14 [See **Comprehensive Environmental Response, Compensation, and Liability Act of 1980.**]

**15 Chronic**

16 Occurring over a long time (more than 1 year) [compare with **acute**].

**17 Chronic exposure**

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

**20 Committed Effective Dose Equivalent (CEDE)**

21 The sum of the products of the weighting factors applicable to each of the body organs or tissues  
22 that are irradiated and the committed dose equivalent to the organs or tissues. The *committed*  
23 *effective dose equivalent* is used in radiation safety because it implicitly includes the relative  
24 carcinogenic sensitivity of the various tissues. The unit of dose for the CEDE is the rem (or, in SI  
25 units, the sievert — 1 sievert equals 100 rem.)

**26 Comparison value (CV)**

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

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1 **Completed exposure pathway**

2 [See exposure pathway.]

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

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

10 **Concentration**

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

13 **Contaminant**

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

16 **Curie (Ci)**

17 A unit of radioactivity. One *curie* equals that quantity of radioactive material in which there are  
18  $3.7 \times 10^{10}$  nuclear transformations per second. The activity of 1 gram of radium is approximately  
19 1 Ci; the activity of 1.46 million grams of natural uranium is approximately 1 Ci.

20 **Dermal**

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

22 **Dermal contact**

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

24 **Detection limit**

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

27 **Disease registry**

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

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

2    The amount of a substance to which a person is exposed over some time period. *Dose* is a  
3    measurement of exposure. *Dose* is often expressed as milligrams (a measure of quantity) per  
4    kilogram (a measure of body weight) per day (a measure of time) when people eat or drink  
5    contaminated water, food, or soil. In general, the greater the *dose*, the greater the likelihood of an  
6    effect. An “exposure dose” is how much of a substance is encountered in the environment. An  
7    “absorbed dose” is the amount of a substance that actually gets into the body through the eyes,  
8    skin, stomach, intestines, or lungs.

9    **Dose** (for radioactive chemicals)

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

12   **Environmental media**

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

15   **Environmental media and transport mechanism**

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

19   **Epidemiology**

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

22   **Exposure**

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

26   **Exposure assessment**

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

30   **Exposure pathway**

31   The route a substance takes from its source (where it began) to its end point (where it ends), and  
32   how people can come into contact with (or get exposed to) it. An *exposure pathway* has five  
33   parts: a **source of contamination** (such as an abandoned business); an **environmental media**

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1 **and transport mechanism** (such as movement through **groundwater**); a **point of exposure**  
2 (such as a private well); a **route of exposure** (eating, drinking, breathing, or touching), and a  
3 **receptor population** (people potentially or actually exposed). When all five parts are present,  
4 the *exposure pathway* is termed a **completed exposure pathway**.

### 5 **Groundwater**

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

### 8 **Hazard**

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

### 10 **Hazardous waste**

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

### 12 **Health consultation**

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

### 18 **Health education**

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

### 21 **Health investigation**

22 The collection and evaluation of information about the health of community residents. This  
23 information is used to describe or count the occurrence of a disease, symptom, or clinical  
24 measure and to estimate the possible association between the occurrence and exposure to  
25 hazardous substances.

### 26 **Health statistics review**

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

### 30 **Indeterminate public health hazard**

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

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**1 Incidence**

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

**4 Ingestion**

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

**7 Inhalation**

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

**10 Intermediate-duration exposure**

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

**13 Isotopes**

14 Nuclides having the same number of protons in their nuclei, and hence the same atomic number,  
15 but differing in the number of neutrons, and therefore in the mass number. Identical chemical  
16 properties exist in *isotopes* of a particular element. The term should not be used as a synonym for  
17 “nuclide,” because “isotopes” refers specifically to different nuclei of the same element.

**18 Migration**

19 Moving from one location to another.

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

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

**24 No apparent public health hazard**

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

**28 No public health hazard**

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

31

1 **NPL**

2 [See **National Priorities List for Uncontrolled Hazardous Waste Sites.**]

3 **Plume**

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

8 **Point of exposure**

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

11 **Population**

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

14 **Prevalence**

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

17 **Prevention**

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

20 **Public comment period**

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

24 **Public health action plan**

25 A list of steps to protect public health.

26 **Public health advisory**

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

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

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

## 6 **Public health hazard**

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

## 10 **Public health hazard categories**

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

## 16 **Radiation**

17 The emission and propagation of energy through space or through a material medium in the form  
18 of waves (e.g., the emission and propagation of electromagnetic waves, or of sound and elastic  
19 waves). The term "radiation" (or "radiant energy"), when unqualified, usually refers to  
20 electromagnetic *radiation*. Such *radiation* commonly is classified according to frequency, as  
21 microwaves, infrared, visible (light), ultraviolet, and x and gamma rays and, by extension,  
22 corpuscular emission, such as alpha and beta *radiation*, neutrons, or rays of mixed or unknown  
23 type, such as cosmic *radiation*.

## 24 **Radioactive material**

25 Material containing radioactive atoms.

## 26 **Radioactivity**

27 Spontaneous nuclear transformations that result in the formation of new elements. These  
28 transformations are accomplished by emission of alpha or beta particles from the nucleus or by  
29 the capture of an orbital electron. Each of these reactions may or may not be accompanied by a  
30 gamma photon.

## 31 **Radioisotope**

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

34

1    **Radionuclide**

2    Any radioactive isotope (form) of any element.

3    **RCRA**

4    [See **Resource Conservation and Recovery Act (1976, 1984).**]

5    **Receptor population**

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

7    **rem**

8    A unit of dose equivalent that is used in the regulatory, administrative, and engineering design  
9    aspects of radiation safety practice. The dose equivalent in *rem* is numerically equal to the  
10   absorbed dose in rad multiplied by the quality factor (1 *rem* is equal to 0.01 sievert).

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

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

14   **Risk**

15   The probability that something will cause injury or harm.

16   **Route of exposure**

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

20   **Sample**

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

25   **Solvent**

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

28   **Source of contamination**

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

**1 Special populations**

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

**5 Stakeholder**

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

**7 Substance**

8 A chemical.

**9 Surface water**

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

**12 Surveillance**

13 [see **epidemiologic surveillance**]

**14 Survey**

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

**18 Toxicological profile**

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

**23 Toxicology**

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

**25 Uncertainty factor**

26 A mathematical adjustment for reasons of safety when knowledge is incomplete — for example,  
27 a factor used in the calculation of doses that are not harmful (adverse) to people. These factors  
28 are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-  
29 effect-level (NOAEL) to derive a minimal risk level (MRL). *Uncertainty factors* are used to  
30 account for variations in people's sensitivity, for differences between animals and humans, and  
31 for differences between a LOAEL and a NOAEL. Scientists use *uncertainty factors* when they

1 have some, but not all, the information from animal or human studies to decide whether an  
 2 exposure will cause harm to people.

### 3 **Units, radiological**

<i>Units</i>	<i>Equivalents</i>
Becquerel* (Bq)	1 disintegration per second = $2.7 \times 10^{-11}$ Ci
Curie (Ci)	$3.7 \times 10^{10}$ disintegrations per second = $3.7 \times 10^{10}$ Bq
Gray* (Gy)	1 J/kg = 100 rad
Rad (rad)	100 erg/g = 0.01 Gy
Rem (rem)	0.01 sievert
Sievert* (Sv)	100 rem

4 \*International Units, designated (SI)

### 5 **Urgent public health hazard**

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

### 9 **Other Glossaries and Dictionaries**

10 Environmental Protection Agency <http://www.epa.gov/OCEPAterms/>

11 National Center for Environmental Health (CDC)

12 <http://www.cdc.gov/nceh/dls/report/glossary.htm>

13 National Library of Medicine <http://www.nlm.nih.gov/medlineplus/mplusdictionary.html>

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## 1 **F. Appendix F: Units of Measurement Used in this PHA**

2 Throughout this document, ATSDR reported observations in many different units of  
3 measurement. While ATSDR can appreciate a desire to use consistent units when measuring a  
4 given phenomenon (e.g., an air concentration), the reality is that many different types of units are  
5 widely used by scientists, often due to conventions that have been followed for many years.  
6 Some of these reporting conventions vary from one type of pollutant to the next.

7 This appendix defines the different units of measurement used throughout this PHA and presents  
8 unit conversion information, where appropriate. This appendix should not be viewed as an  
9 exhaustive account of units of measurement. Rather, it provides perspective on the units  
10 presented throughout this PHA.

11 Units used when reporting concentrations of radioactive contaminants

12  $\text{aCi/m}^3 =$  attocuries per cubic meter

13  $\text{pCi/m}^3 =$  picocuries per cubic meter

14  $\mu\text{Ci/ml} =$  microcurie per milliliter

15 Note: The following information may be useful for appreciating the terminology used in these  
16 units of measurements and for converting between the units:

17  $1,000,000 \mu\text{Ci} = 1 \text{ Ci}$

18  $1,000,000 \text{ pCi} = 1 \mu\text{Ci}$

19  $1,000,000 \text{ aCi} = 1 \text{ pCi}$

20  $1,000,000 \text{ ml} = 1 \text{ m}^3$

21 Units used when reporting concentrations of non-radioactive contaminants

22  $\mu\text{g/m}^3 =$  micrograms per cubic meter

23  $\text{ppm} =$  parts per million

24 Notes: Scientists typically report ambient air concentrations of particulate matter and metals in  
25 units of micrograms per cubic meter.

26 There is no widely used convention for reporting ambient air concentrations of organics  
27 and inorganic compounds. Some scientists use mass concentrations (e.g., micrograms per cubic  
28 meter and variations upon this unit); other scientists use volume concentrations (e.g., parts per  
29 million and variations upon this unit).

30

## 1 Units used when reporting stack gas concentrations

2 grains/dscf = grains per dry standard cubic foot

3 ng/dscm = nanograms per dry standard cubic meter

4  $\mu\text{g/dscm}$  = micrograms per dry standard cubic meter5 Notes: Grains are a mass measurement commonly used when reporting stack gas concentrations  
6 of particulate matter. There are 7,000 grains in a pound.7 “Nanograms” and “micrograms” are commonly used when reporting stack gas  
8 concentrations of trace gases, such as PCBs and dioxins. There are 1,000,000 micrograms in a  
9 gram, and there are 1,000,000,000 nanograms in a gram.

## 10 Units used when reporting mass emission rates

11 lb/hour = pounds per hour

12 lb/day = pounds per day

13  $\mu\text{g/second}$  = micrograms per second

14 ng/second = nanograms per second

15 Note: The most appropriate unit of measurement for mass emission rates is often based on  
16 reporting convention and regulatory requirements. Some regulations, for instance, require facility  
17 operators to report maximum hourly emission rates; in such cases, pounds per hour might be an  
18 acceptable unit of measurement. The pollutants also determine what units are most appropriate.  
19 Pollutants present in very trace amounts (e.g., dioxins) often are reported in terms of micrograms  
20 or nanograms.