

EOH 353 GLOSSARY

Global Perspectives of Environmental Health

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CHAPTER 0. ONLINE RESOURCES: (chapter number corresponds to the week in the semester)

0. **CSUN Library search:** <http://library.csun.edu/>
Search engine for technical articles at the CSUN library (OneSearch is an all-purpose search engine)
1. **CDC:** <https://www.cdc.gov/other/searchtips.html> search engine
CDC updates: <https://www.cdc.gov/other/emailupdates/> email updates
CDC podcasts: <https://www2c.cdc.gov/podcasts/rss.asp> informational podcasts
2. **FDA:** search engine. **[L.A. County restaurant grading system](#)**
3. **CDPH:** <https://www.cdph.ca.gov/>
Search engine for the California Department of Public Health – information on diseases, climate change, vectors/pesticides, emergency preparedness, safety, and registered environmental health specialists
4. **IPM:** Integrated pest management. Pests of homes, structures, people, and pets.
5. **EPA:** <https://www.epa.gov/aboutepa/epas-administrator> search engine
EPA updates: <https://www.epa.gov/newsroom> email updates
6. **Superfund sites:** <https://www.epa.gov/superfund/search-superfund-sites-where-you-live>
TRI search: Toxic materials (not waste) where you live: enter zip code, click on facility profile, then chemicals
7. **EPA Drinking water standards:** National drinking water standards from the EPA
ChemIDplus: Toxnet database provides chemical structures/properties for a large range of chemicals.
8. **California EPA:** <https://www.calepa.ca.gov/>: search engine for California EPA
CA EPA updates <https://agency.calepa.ca.gov/Listservs/>: receive email updates
Household Products Database: Toxnet database on wide range of household products.
9. **Hazardous Substances Data Bank:** <http://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm>
Search engine for the Environmental Protection Agency.
Integrated Risk Information System: <http://www.epa.gov/iris/index.html>
Search engine for risk database managed by the EPA.
ITER International Toxicity Estimates for Risk.
Risk information for over 600 chemicals from authoritative groups worldwide
ToxNet : <https://toxnet.nlm.nih.gov/>
Search engine for Toxicology Network, including HSDB, IRIS, ITER, TOXLINE, etc.
10. **ATSDR:** <https://www.atsdr.cdc.gov/substances/index.asp>
Search engine for the Agency for Toxic Substances and Disease Registry.
Tox Faqs (ATSDR): <https://www.atsdr.cdc.gov/toxfaqs/index.asp>
Search engine for toxicology frequently asked questions.
11. **Radiation:** types of radiation, with examples.
UV index by zip code: <https://enviroflash.epa.gov/uv/Subscriber.do?method=start>
12. **Criteria Air pollutants:** EPA information on criteria air pollutants
AQMD: <http://www.aqmd.gov/> South Coast Air Quality Management District
Air quality by zip code: <http://www.enviroflash.info/signup.cfm>
13. **187 toxic air pollutants:** EPA information on hazardous air pollutants (“air toxics”)
14. **World clock:** current information on world population, environment, food, water, energy, health
<https://www.epa.gov/sustainability>: EPA information on sustainability

CHAPTER 1. BASICS

18. ENVIRONMENTAL HEALTH

The area of **public health** that studies how the **environment affects human health**. While investigations can unfold in many ways, there is a chronological order to environmental health: it starts with environmental exposures, followed by health effects, followed by the institution of appropriate controls.

19. PUBLIC HEALTH

All of the organized measures devoted to the **prevention** of disease and **promotion** of health, from a community **perspective**

20. HEALTH

A state of complete **physical, mental, and social well-being**, and not merely the absence of disease or infirmity (definition by the World Health Organization). As such, health is an ideal that is never fully achieved.

21. ENVIRONMENT

The complex of **physical, chemical, biological, psychological, and sociological** factors that act upon the health of an organism or community (i.e., “anything that is not me”)

22. EPIDEMIOLOGY

The study of the **distribution** and **determinants of disease**; an epidemiological study typically compares two groups who are alike except for one factor (such as exposure to a chemical or the presence/absence of a health effect), and then looks for an association between exposure and effect

23. GEOGRAPHIC INFORMATION SYSTEMS (GIS)

A system designed to incorporate all types of spatial or geographical data; **location** can then be analyzed for differences in exposure and effect

24. TOXICOLOGY

The study of poisons (also called toxicants)

TOXIN: Poisons produced within living cells or organisms (a subset of toxicants)

25. LD50

The lethal dose for 50% of the test population; also called the median lethal dose. LD50 is usually expressed as mg/kg (milligrams of a chemical divided by kilograms of body weight). The lower the LD50, the higher the toxicity (in other words, if a smaller amount of chemical can kill 50 % of the population, it is much more toxic).

26. SYNERGISM

The concept that the whole is greater than the sum of its parts; in toxicology: two harmful agents, when combined, can cause harm that is **greater** than an expected additive effect; (e.g., asbestos + smoking together can magnify the rates of lung cancer)

27. POTENTIATION

A relatively harmless material can **magnify** the effect of another harmful contaminant (e.g., $\text{SO}_x + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$, where H_2SO_4 is more harmful)

28. ANTAGONISM

An interaction among agents that **lessens** the total effect (e.g., arsenic + selenium can partially cancel each other out)

29. TOLERANCE

Developing **resistance** to harmful chemicals after **repeated exposures** (e.g., ozone)

30. **BIOACCUMULATION**
A process when trace amounts of a substance (e.g. heavy metals) become more concentrated as they move up the food chain (and are therefore more harmful); also called biomagnification
31. **INTERROGATIVES**
The questions used in virtually any effective investigation: **who, what, when, where, why, and how?** These are reflected in terms throughout this glossary, such as: who (cases), what (agents), when (incubation period), where (GIS), why (health effects, litigation), and how (toxicology, risk)
32. **SUSTAINABILITY**
Development that meets all the **needs of the present** without compromising the ability of **future** generations to meet their own needs (Brundtland Commission of the United Nations, 1987)
33. **RISK / RISK ANALYSIS**
The **probability** of injury, disease or death; (e.g., the risk of death from an exposure could be one in a million) / A collection of approaches and disciplines devoted to all aspects of risk issues (including risk assessment, risk communication, and risk management).
34. **RISK ASSESSMENT**
Techniques for estimating the probability that exposed people may have adverse health effects (e.g., one out of a million). The 4 steps are **hazard identification; dose-response assessment; exposure assessment; and risk characterization** (designed below)
35. **HAZARD IDENTIFICATION**
A step in risk assessment to determine whether a particular agent is **causally linked** to a health effect
36. **DOSE-RESPONSE ASSESSMENT**
A step in risk assessment that determines the relationships between dose and response (a health effect). The response is usually measured in the percentage of subjects responding with a given health effect, which can then be expressed as a probability (e.g., 1% is one in a hundred). Health risks can be viewed as a function of dependent variables (e.g., age, gender, other health conditions, as well as exposure).
37. **EXPOSURE ASSESSMENT**
To determine the extent of human **contact** with a harmful agent that describes how often and for how long, and the nature and size of the population (especially useful both before and after the application of regulatory controls)
38. **RISK CHARACTERIZATION**
To describe the **nature and often the magnitude of human risk**, including uncertainties. Typically, a risk may be described as one-in-a-million (or more or less), which can be used to make decisions.
39. **BENCHMARK DOSE**
The dose that induces a **specific risk** (e.g., a dose resulting in a risk of 1 in a million having cancer)
40. **RISK COMMUNICATION**
An **interactive** exchange of **information and opinions** among individuals, groups, and institutions regarding risk (includes identifying the source, message, channels of communication, and audience).
41. **RISK MANAGEMENT**
The evaluation, selection, and implementation of alternative risk control **actions**
42. **HIERARCHY OF CONTROLS**
A general set of controls for various environmental hazards, in order of decreasing effectiveness: **elimination, substitution, isolation, administrative controls** (including laws), and **personal protective equipment**. Effective controls depend on an understanding of the risks.

LAW

43. RIGHTS
A **power**, privilege, or interest that is protected by law
44. DUTIES
The corresponding responsibility to respect a **right**. The law must balance rights and duties
45. STARE DECISUS
A Latin expression that means "the decision stands." A principle that says the best predictors of a legal decision are **prior decisions**
46. CONSTITUTIONAL LAW
Fundamental laws of a government, including federal and state constitutions, and **city charters**
47. STATUTORY LAW
Laws passed by the **vote** of a legislature (elected officials) or public; includes statutes, ordinances, referenda
48. ADMINISTRATIVE LAW
Laws written by appointed officials (in **agencies**) that include **rules and regulations**. These laws take precedent over **common law**, but are subject to statutory and constitutional law.
49. **COMMON LAW**
Laws taken from **previous court decisions**: includes nuisance laws and eminent domain
50. NUISANCE LAWS
Government may limit the **use of property** if it harms others or is "unreasonable"
51. EMINENT DOMAIN
Government may "**take**" **property** if it is in the public interest, and fair compensation is made (e.g., embargo)
52. POLICE POWER
States have the authority to **enforce their own laws**, as granted by the **10th amendment** to the U.S. Constitution
53. MALFEASANCE
Unauthorized (**wrongful**) act by an official (e.g., bribes)
54. MISFEASANCE
Authorized act done in an **unauthorized** manner (e.g., revoking a permit without justification)
55. **NONFEASANCE**
Failure to **perform** duty without an acceptable excuse (e.g., ignoring a known health hazard)
56. DUE PROCESS
Fairness and completeness of the law by the federal government (5th amendment) and the states (14th amendment); government must respect all legal rights owed to a person
57. EQUAL PROTECTION
Consistency of the law; however, specific parties may be treated differently if supported by evidence (e.g., conducting more inspections for facilities with a greater risk or previous significant violations)

58. **EXCLUSIONARY RULE**
Evidence that is **not legally obtained may not be used in court**
59. **DEMURRER:**
admit to the facts but challenge legal propriety
e.g., if evidence was illegally obtained, then the defendant would be expected to file a demurrer.
60. **LITIGATION**
To settle a dispute in a **court of law**
61. **ARBITRATION**
A formal process to settle a dispute out of court in a legally binding settlement with the services of a **disinterested person** (i.e., an arbitrator)
62. **NEGOTIATION**
To settle a dispute out of court in an informal, legally **nonbinding** settlement between the interested parties. A great deal of progress in environmental health occurs because of skillful negotiation.
63. **ADMINISTRATIVE HEARINGS**: formal and informal means to gain information and clarify positions

CHAPTER 2. COMMUNICABLE DISEASE

64. **COMMUNICABLE DISEASE**
An infectious disease caused by **transmission** of an **agent** (or its by-product) from **reservoir to host**
65. **TRANSMISSION**
Mechanism that exposes host to infectious agents
66. **AGENT**
A **factor** that must be present for a disease to occur in a susceptible host (e.g., microbes, toxins, chemicals, radiation); may also refer to the absence of a factor in deficiency diseases
67. **RESERVOIR**
The **habitat** in which an infectious agent normally lives, grows and multiplies (includes animals and humans)
68. **HOST**
Any animal infected by an agent under natural conditions; the interaction of host, agent, and environment is referred to as the epidemiologic triangle or **epidemiologic triad**
69. **INFECTION:**
growth of a pathogenic microbe in a host (with or without evidence of disease)
70. **PATHOGENICITY**
Capable of producing disease = number of cases / number infected
71. **VIRULENCE**
The **harmfulness** of a disease (e.g., case fatality rate = deaths / cases).
72. **INCUBATION PERIOD**
The **time** between **exposure** to an agent and the first sign or symptom of **disease**, especially in reference to **infections**; some pathogens can spread during this time
73. **CARRIER**
A person or animal that harbors pathogens **without showing symptoms**

74. **FOMITES**
An **inanimate object** (such as a dish, toy, book, doorknob, or clothing) contaminated with infectious
75. **INCIDENCE**
The number of **new cases** within a time frame divided by the number of people **at risk**; also known as **disease attack rate**
76. **PREVALENCE**
The number of existing **cases** at a point in time divided by the **total population**
77. **DIRECT CONTACT**
Organisms transmitted from a source to susceptible host **without an intermediate object** (also called **person-to-person** transmission). (e.g., **sneezing, touching, sexual transmission**)
78. **INDIRECT TRANSMISSION**
Vehicle-borne, vector-borne, and airborne transmission of a disease
79. **VEHICLE BORNE**
Indirect transmission of an infectious agent that occurs when a vehicle (an **inanimate object or material**) touches the person's body, or is ingested
80. **VECTORBORNE TRANSMISSION**
Transmission by **insects** or other animals
81. **AIRBORNE**
Transmission of disease through air (e.g., coughing, sneezing, dust)
82. **INFESTATION:**
For humans and animals: lodgment, development, and reproduction of arthropods on the surface of the body or in clothing; For articles and premises: harboring or sheltering of animals (especially arthropods or rodents).
83. **LATENCY PERIOD**
The **time** between a disease's first **presence** and its **recognition**, especially in reference to **carcinogens**
84. **MORBIDITY/MORTALITY**
Illness/death
85. **CASE FATALITY RATE**
The number of **deaths** divided by the number of **cases**
86. **LIFE CYCLE ANALYSIS**
A process to assess the impacts from all stages of a product's life (i.e., from **cradle to grave**)
87. **HOST FACTORS**
Features that affect the **susceptibility** of the host to a disease, which may include **intrinsic** (age, gender, race, genetic factors, immunologic state) and **extrinsic** (personal habits, nutritional status, psychological stress); host factors vary with diseases
88. **FECAL/ORAL TRANSMISSION**
Transmission of agents from the fecal waste of one host to the oral cavity of another host (through contamination)
89. **DROPLET NUCLEI**

The material that remains after **evaporation** of moisture from a sneeze, cough, or exudate (e.g., the means of transmission of tuberculosis)

90. **INFLUENZA**

A common viral disease spread mainly by droplets from affected hosts coughing, sneezing or talking; preventable with **vaccines**; classified by serotypes based on antibody response (e.g., [H1N1](#))

91. **MYCOBACTERIUM**

A genus of bacteria (not fungi, despite its name) that includes agents of **tuberculosis and leprosy**

92. **TUBERCULOSIS**

Mycobacterium spread primarily by droplet nuclei (in the air); prevention through ventilation

93. **COCCIDIIOIDES**

A genus of **fungi** that lives in **hot, dry, dusty areas**, and causes coccidioidomycosis, or valley fever (C. immitis) by inhalation of dust with the fungi

94. [**SALMONELLA**](#)

A genus of rod-shaped, Gram-negative bacteria in both cold- and warm-blooded animals, as well as the environment, causing illnesses such as **typhoid fever, paratyphoid fever, and food poisoning** (salmonellosis); does not require vaccinations for international travel

[**SALMONELLA TYPHI**](#)

The agent of typhoid fever, spread by fecal or urine contamination of food or water (also by flies); can be asymptomatic

[**SALMONELLA PARATYPHI**](#)

The agent of paratyphoid fever, spread by fecal or urine contamination of food or water (also by flies); can be asymptomatic; less virulent than typhoid

[**SALMONELLA TYPHIMURIUM**](#)

One of the most **common** forms of **salmonella** that is a cause of foodborne illness

[**SALMONELLA ENTERITIDIS**](#)

Another food related illness caused by a salmonella that can survive in uncracked eggs from chickens

95. [**SHIGELLA**](#)

A genus of Gram negative, facultative anaerobic, rod-shaped bacteria closely related to Salmonella that is a leading cause of diarrhea (typically **dysentery**) in primates worldwide; an example of **toxin-mediated infection**

96. **HELMINTHS**

Parasitic worms that include:

NEMATODES: Roundworms; especially Anisakidae, Ancylostoma (Hookworm), Ascaris, and Trichinosis

TREMATODES: Flukes; especially Schistosoma

CESTODES: Tapeworms; especially Taenia, Diphylobothrium, and Echinococcus

ANISAKIDAE: A group of **nematodes** normally found in the gut of various fish, these worms can invade the muscle tissue after the **fish dies**, which can then cause a food related illness called **Anisakiasis** in fish consumed **raw** (sushi, sashimi, etc.)

97. [**TAENIA**](#)

Tapeworm (helminth); often **asymptomatic**, all tapeworms deprive carriers of nutrients, and pork tapeworms can lead to **seizures**

[**TAENIA SAGINATA**](#) **Beef tapeworm**; transmission is usually from eating **raw or undercooked** beef

[**TAENIA SOLIUM**](#) **Pork tapeworm**; transmission is usually from eating **raw or undercooked** pork; often **asymptomatic**, but can lead to **seizures**

[**TAENIA ASIATICA**](#) **Asian tapeworms**; discovered in 1980s; once regarded as a slightly different strain of *Taenia saginata*

[**DIPHYLLOBOOTHRIUM LATUM**](#) **Fish tapeworms**; tapeworms in fish; transmitted from eating raw or undercooked fish

98. **ASCARIS**
A genus of **roundworm** found rarely in the U.S., infects an estimated one **billion** people; transmission by fecal contamination of food or water; the eggs are not infective for about **18 days**; this disease is prevented by **timely disposal** of human fecal waste
99. **SCHISTOSOMA**
A genus of trematodes that lives in certain freshwater **snails**; causes schistosomiasis (also known as bilharzia); infects roughly 200 million people, prevented by protecting fresh water from fecal contamination
100. **TRICHINOSIS**
A disease transmitted by eating raw or undercooked meat (especially from **pork**, but also various wild animals) that is infected with microscopic roundworms from the genus **Trichinella**; the key to prevention is to cook meat thoroughly to safe temperatures
101. **TINEA**
A group of **fungi** (dermatophytes) that live on skin, hair, and nails, and thrives in warm moist areas [e.g., **ringworm** (rash on skin shaped like a ring), T. pedium (**athlete's foot**), T. cruris (**jock itch**), T. unguium (**fingernails and toenails**)]
102. **CLOSTRIDIUM**
A genus of anaerobic Gram-positive bacteria producing **hardy endospores** that survive harsh conditions (e.g., agents for botulism, tetanus) and produces toxins.
CLOSTRIDIUM BOTULINUM
Agent for botulism; anaerobic spore-former that prefers neutral pH; spores killed by 248 deg F for 20 minutes; symptoms include blurred vision, slurred speech; incubation 12-36 hours
CLOSTRIDIUM PERFRINGENS Agent for perfringens poisoning; **Toxin-mediated infection**
CLOSTRIDIUM TETANI In soil, street dust, and animal feces; can enter wounds, resulting in tetanus (muscular contractions and spasms; untreated, case fatality is high); controlled by cleaning wounds, immunizations, and antibiotics
103. **BACILLUS**
A genus of Gram-positive, rod shaped bacteria found in **soil** that includes anaerobes
BACILLUS CEREUS Toxins can cause **food poisoning**
BACILLUS ANTHRACIS The agent of **anthrax** found in **cattle** and other animals; transmitted by **contact with hides**, meat, or flies, resulting in **itchy skin**; **complications** if untreated; controlled by vaccines, sanitation, dust control
BACILLUS THURINGIENSIS
A bacteria used as a common biological **pesticide**
104. **HEMOLYTIC UREMIC SYNDROME:**
E. Coli 0157:H7 in undercooked beef causes bloody diarrhea, then releases **Shiga toxins** that destroy red blood cells (hemolytic) leading to acute kidney failure (uremia); the most common cause of **acute renal failure in children** under 5; caused less often by salmonella, shigella, some viruses, campylobacter, some chemotherapy, and inherited conditions; **Toxin-mediated infection**
105. **VIBRIO**
A genus of Gram-negative bacteria typically found in **salt** water, (e.g., V. cholerae, V. parahaemolyticus, V. vulnificus)
VIBRIO CHOLERA Spread by fecal contamination, especially found in **salt** water; symptoms include severe diarrhea and dehydration
VIBRIO PARAHAEMOLYTICUS Foodborne infections, usually from undercooked **seafood**
106. **RICKETTSIA**

A group of Gram-negative bacteria that depends on entry, growth, and replication **within the cytoplasm** of eukaryotic cells; transmitted mostly by **ticks**, but also by fleas, lice, and mites; includes the **typhus** group and **spotted fever** group

107. **FUNGI**

A kingdom of eukaryotic organisms, characterized by **cell walls** containing **chitin** and formation of **spores** (e.g., Aspergillus, Stachybotrys, Tinea, Coccidioides, Histoplasma, Pneumocystis)

ASPERGILLA: a genus of common mold (fungi) that is naturally present **outdoors** but, multiplies in **damp** indoor environments, causing a range of allergic, respiratory, and other symptoms

STACHYBOTRYS: a genus of common mold (fungi), also known as **black mold**, commonly found in **damp** indoor environments; can aggravate allergies, asthma, and other symptoms in the upper respiratory tract

HISTOPLASMOSIS: A fungus found in soil that contains large amounts of bird or bat droppings.

108. **PROTOZOA**

Microscopic, one-celled organisms that are one of three classes of **pathogenic parasites**, along with helminths and ectoparasites; includes Plasmodium, Entamoeba, Giardia, Cryptosporidia, Toxoplasma, Cyclospora, Leishmania, and Trypanosoma

109. **PLASMODIUM**

A protozoan parasite that includes the agents of **malaria**; the two phases of its life cycle are in vertebrates (including humans) and mosquitoes

110. **LYSSAVIRUS**

A genus of RNA virus including the **Rabies** Virus, transmitted mostly by the bite from infected animals (especially skunks, foxes, dogs, and cats); prevented by **vaccination** of pets

111. **BIOTERRORISM**

Terrorism involving the release of toxic biological agents (e.g., Anthrax, Botulism, Plague, Smallpox, Tularemia, and Viral hemorrhagic fevers); terrorism may also involve the release of **chemical agents**; physical agents could involve the release of radionuclides as well as conventional explosives. While the agents may include traditional environmental health risks, the fundamental differences are that the risks are deliberately imposed for the purpose of terrorism, and law enforcement should also be involved in its control

CHAPTER 3. FOOD

112. **FOOD RELATED ILLNESS**

Any aspect of food that may cause illness (e.g., infections, intoxications, physical hazards such as broken glass); it is also called foodborne illness and food poisoning

113. **GASTROENTERITIS**

The technical term for **vomiting** (gastritis) and **diarrhea** (enteritis)

114. **FOODBORNE OUTBREAK**

An incident when two or more persons experience a similar illness after ingestion of a common food; two exceptions to this definition: when botulinum and chemical poisons are the suspected agents (in these cases, one person is enough to declare an outbreak)

115. **POTENTIALLY HAZARDOUS FOOD**

Food supporting the rapid and progressive growth of microorganisms that cause food infections or food intoxications; foods are automatically considered potentially hazardous unless: the pH is less than 4.6; the water activity is less than 0.85 (i.e., foods high in salt or sugar); canned foods; irradiated foods; and any foods exempted because of microbial challenge studies (i.e., proof that a food does not support such growth). An exception to “rapid and progressive growth” is *Clostridium botulinum* (the agent of botulism),

because even a modest growth of this agent can produce deadly toxins.

112. Surface to volume ratio (S/V)

The greater the surface to volume ratio for an object, the faster it will cool off (or warm up). For example, if a cup of coffee spills on the floor, it has the same volume but a much higher surface area, and will cool off faster. S/V is important in food safety because longer times to cool off will raise the risk of food related disease.

113. TEMPERATURE DANGER ZONE FOR POTENTIALLY HAZARDOUS FOODS

Potentially hazardous food may not be stored in the danger zone of 41-135 deg. Fahrenheit for more than 6 hours (also, no more than 2 hours at 70-135 F.)

116. FDA TOP RISK FACTORS FOR FOOD

One way to remember the risk factors is the acronym CHEST:

Cooking (inadequately cooked foods),

Hygiene (poor personal hygiene),

Equipment (contaminated equipment),

Sources (unlicensed sources that sell food),

Temperatures (holding temperatures in the danger zone)

117. FOODBORNE INFECTIONS

The multiplication of microbes from food, such as bacteria, viruses, and parasites that are not normally present within the body; an infection might cause no symptoms (subclinical); **fever** is the most typical symptom; relative to food, most of the infection occurs **after eating**

118. INTOXICATION

Release of **exotoxins** produced by microbes growing in food; relative to food, toxins are produced **before eating**; **vomiting** is the most typical symptom

119. TOXIN-MEDIATED INFECTIONS

Infection with microbes that also produce **toxins**; bacteria are consumed with the food and the toxin is then produced within the body; **Incubation** period is generally **longer** than intoxications, but shorter than infections (e.g., all the Shigella, Clostridium perfringens, and E. coli 0157:H7); also known as **toxic infection**

120. TOXINS

Poisons

121. EXOTOXIN

Poisons secreted by bacteria **externally** to their environment while still **alive**, and the source of most food intoxications; tends to be associated with **gram-positive** bacteria

122. INCUBATION PERIODS FOR COMMON AGENTS

The incubation period for a food related illness does not by itself indicate the agent involved, but it can often rule out agents that do not fit with the known incubation period.

123. SALMONELLA

A genus of rod-shaped, Gram-negative bacteria in both cold- and warm-blooded animals, as well as the environment, causing illnesses such as **typhoid fever, paratyphoid fever, and food poisoning** (salmonellosis); does not require vaccinations for international travel

124. CAMPYLOBACTER

The most common bacterial cause of human gastroenteritis in the world

125. LISTERIA

A genus of gram-positive bacteria (especially Listeria monocytogenes) that are **psychrophilic** (resists

and survives cold temperatures)

126. **HEPATITIS**

Inflammation of the liver; causes include viruses, drugs, alcohol, and chemicals; certain virus types are transmitted in food, water, or blood; some prevented with **vaccines**

127. **HEPATITIS A**

Viral infection transmitted by the **fecal-oral** route (including person-to-person and contaminated food or water); a self-limited disease that does not result in chronic infection ("infectious hepatitis")

128. **ANISAKIASIS**

A group of **nematodes** normally found in the gut of various fish, these worms can invade the muscle tissue after the **fish dies**, which can then cause a food related illness called **Anisakiasis** in fish consumed **raw** (sushi, sashimi, etc.)

129. **STAPHYLOCOCCUS**

A genus of Gram-positive bacteria; their **exotoxins** are a common cause of food poisoning, produced in potentially hazardous foods stored at 41-135 deg. F. Incubation period of 2-4 hours.

130. **CLOSTRIDIUM**

A genus of anaerobic Gram-positive bacteria producing **hardy endospores** that survive harsh conditions (e.g., agents for botulism)

CLOSTRIDIUM BOTULINUM

Agent for botulism; anaerobic spore-former that prefers neutral pH; spores killed by 248 deg F for 20 minutes; symptoms: blurred vision, slurred speech; incubation 12-36 hours

CLOSTRIDIUM PERFRINGENS Agent for perfringens poisoning; **Toxin-mediated infection**

131. **RED TIDES**

This refers to a population explosion of **red algae**, usually during the summer months, which produce toxins that may be concentrated in **shellfish (PSP)**, fish feeding on reefs (**ciguatera**), and may kill fish and other marine organisms

132. **PARALYTIC SHELLFISH POISONING (PSP)**

A food related illness caused by toxins produced by a **dinoflagellate** that become concentrated within certain shellfish; these dinoflagellates have a red-brown color and are associated with "red tides"

133. **CIGUATERA / CIGUATOXIN**

A toxin in fish feeding on reef algae

134. **SCOMBRIDAE / SCOMBROID / SCOMBROTOXIN**

A taxonomic family of fish that produces histamines (e.g., tuna, bluefish); **Histamine Poisoning**

135. **VIBRIO**

A genus of Gram-negative bacteria typically found in **salt** water, (e.g., V. cholerae, V. parahaemolyticus, V. vulnificus)

VIBRIO CHOLERA Spread by fecal contamination, especially found in **salt** water

VIBRIO PARAHAEMOLYTICUS Foodborne infections, usually from undercooked **seafood**; rarely fatal.

136. **COPPER POISONING**

Caused by prolonged contact with copper under pressure; incubation period of less than a half hour

137. **PASTEURIZATION**

Heating foods to **destroy pathogens** and spoilage agents **without radically affecting taste** or other quality characteristics

138. [RAW MILK](#)
Unpasteurized milk
139. **BATCH PASTEURIZATION**
145 deg F for 30 minutes
140. **HTST PASTEURIZATION**
161 deg F for 15 seconds
141. **UHT PASTEURIZATION**
191-212 deg F for 1-.01 seconds; also called flash method
142. **ULTRA-PASTEURIZATION**
280 deg F for >2 seconds: the strictest time-temperature conditions of the methods listed here (many say that it degrades the taste the most)
143. [SPOILAGE ORGANISMS](#)
Bacteria that are **not pathogens** (i.e., cause disease) but can spoil food
144. **DISHWASHING (MANUAL)**
Requires a 3-compartment sink (washing, rinsing, and sanitizing) at 180 deg F for at least 30 seconds; chemical sanitizers **include chlorine (100 ppm for 30 seconds), quaternary ammonia (200 ppm for 1 minute), or iodine (25 ppm for 1 minute)**; the most important step is adequate **washing**
145. **DISHWASHING (Machine method)**
wash: 140-160 deg. F
rinse: 180 deg F, 10 seconds, 15-25 psi (water pressure)
or chlorine rinse (50 ppm)
146. **NSF ([NATIONAL SANITATION FOUNDATION](#))**
A **non-profit** organization that issues **standards** for food service equipment such as dishwashing machines (along with many other standards)
147. [HACCP](#)
Hazard Analysis and Critical Control Points: an approach to food safety based on 7 steps:
Analyze hazards, identify critical control points (where risks can be minimized), establish critical limits, monitor, take corrective actions, keep records (data), and verify that all the steps are being taken (completed by an environmental health professional).

CHAPTER 4. VECTORS

148. **PESTS**
A nonhuman organism harmful to **human interests**; includes aesthetics and economic harm as well as disease; pests may be useful in one context (e.g., balance to ecosystems) but harmful in another context (e.g., disease)
149. **VECTOR**
A nonhuman organism (usually **arthropods**) that transmits **disease** (i.e., carries an agent from a reservoir to a susceptible host). Pest has a broader meaning than vectors.
150. [MECHANICAL TRANSMISSION](#)
A vector that offers **physical** transfer of an agent from reservoir to host
151. [BIOLOGICAL TRANSMISSION](#)
A pathogen that must undergo **biological** changes within the vector before transmission to a new host

152. **ZOONOSES**
Diseases spread between animals and humans; [examples](#) include rabies, leptospirosis, tularemia, and plague
153. **ARTHROPODS**
A phylum of invertebrate animals that include **insects and arachnids**
154. **ARBOVIRUS**
An **arthropod borne** virus; any virus transmitted by an arthropod to humans
155. **INSECTS**
Characterized by 3 pairs of legs and 3 body segments (head, thorax, abdomen); **e.g., cockroaches, fleas, flies, mosquitoes, lice**
156. **ARACHNIDS**
Characterized by 4 pairs of legs and 2 body segments (cephalothorax, abdomen); **e.g., ticks, mites, spiders**
157. **BITING FLIES**
e.g., sand flies, horseflies, and deerflies
158. **NONBITING FLIES**
Mechanical vectors that are generally a sign of poor sanitation (especially **houseflies**, but also bottleflies, screwworm flies, and many others). The larval stage of a fly is called a **maggot**.
159. **COCKROACHES**
A primarily **nocturnal, mechanical vector** that is a common pest around the world; their **egg casings** are especially hardy; there are thousands of species, but the most common cockroaches are the American, Oriental, Brown-banded, and German (see below). The eggs of the cockroach are most resistant to pesticides – as a result, pesticides that break down quickly are less effective in controlling roaches.
[AMERICAN COCKROACH](#)
Pareplaneta americana ~ 1.5 inches or more; reddish brown; the **largest** of the most common cockroaches
[ORIENTAL COCKROACH](#)
Blatta orientalis ~ 1 inch, **brown or black**; sometimes called a **water bug**
[BROWN-BANDED COCKROACH](#)
Supella longipalpa ~ 1/2 inch, light brown w/ dark **brown bands**; also called a furniture roach
[GERMAN COCKROACH](#)
Blatella germanica ~ 1/2 inch, **light brown**; one of the most common cockroaches in the world, the females carry their eggs the longest before releasing them.
160. **FLEAS**
Vectors of murine typhus and bubonic plague, commonly associated with dogs and cats, but found in a wide range of animals
161. **CTENOCEPALIDES CANIS**
Dog Flea (not normally a vector)
162. **CTENOCEPALIDES FELIS**
Cat Flea (not normally a vector)
163. **XENOPSYLLA CHEOPIS**
Oriental Rat Flea (a serious vector of disease)
164. **MUSCA DOMESTICA**
The common house fly; a mechanical vector for a wide range of pathogens

165. **MOSQUITOES**
A group of biting insects that can transmit Dengue, Chikungunya, Zika, and Malaria (e.g., **anopheles, aedes, and culex** – see below)
166. **AEDES MOSQUITO**
Mosquitoes that transmit dengue fever, yellow fever, etc.; e.g., *A. albopictus* (Asian tiger mosquito) and *A. aegypti* (yellow fever mosquito); their larvae can be identified by their short breathing tube and by laying at varying angles to the water line. Found mostly in tropical and sub-tropical, but can found in North America.
167. **ANOPHELES MOSQUITO**
Transmits **malaria**; found especially (but not exclusively) in tropical regions; larvae have **no breathing tube** and float **parallel** to the water line
168. **CULEX MOSQUITO**
Found especially in **North America**; transmits West Nile virus; larvae have a very **long thin breathing tube** and lay at a 45 deg angle to the water line
169. **LICE**
A parasitic insect that can be found on people's **heads and bodies**, including the pubic area; they **feed** on human blood
170. **PEDICULUS HUMANUS**
Body lice; the form of lice most associated with the transmission of disease
171. **PEDICULUS CAPITIS**
Head lice
172. **PTHIRUS PUBIS**
Pubic lice
173. **TICKS**
Small arachnids that, along with mites, constitute the subclass Acarina, and are major vectors; they are **ectoparasites** (external parasites), living on the blood of mammals, birds, and sometimes reptiles and amphibians
174. **MITES**
Small arachnids, especially associated with **Scabies**; their larval stage is called **chiggers**.
175. **SCABIES**
Also known as sarcoptic itch or acariases, caused by infestation of **mites** (*Sarcoptes scabiei*) spread by direct contact; the mites can burrow into skin within 3 minutes, causing itching and lesions
176. **RODENTS**
A taxonomic order that includes rats, mice, guinea pigs, hamsters, capybaras, squirrels, prairie dogs, porcupines, and beavers
177. **NORWAY RATS (*RATTUS NORVEGICUS*)**
The **larger** of the common rats in urban environments; their **tail is shorter** than the body; sometimes called the brown rat
178. **ROOF RATS (*RATTUS RATTUS*)**
The **smaller** of the common rats in urban environments; their **tail is longer** than the body; sometimes called the black rat
179. **MUS MUSCULUS**
The common house mouse

Mosquito-borne:

180. [MALARIA](#)

A disease spread by the **anopheles** mosquito (a biological vector) caused by a parasite from the genus **plasmodium**; symptoms: fever, chills, and flu-like illness

181. [YELLOW FEVER](#)

A disease caused by the Yellow Fever virus (a flavivirus) transmitted by infected mosquitoes (primarily *Aedes aegypti*), highly **virulent to visitors** in endemic areas of **South America and Africa**; symptoms include **fever** and **jaundice** (jaundice is the **yellowing** of skin and eyes caused by breakdown of red blood cells; when the liver cannot process these red blood cells, there is a build-up of bilirubin with yellow pigment).

182. **Arthropod-born viral encephalitis**

Includes **West Nile virus**, as well as Eastern equine encephalitis, Western equine encephalitis, California encephalitis; Reservoir unknown for most agents (possibly birds, rodents, bats, reptiles) found in more temperate areas (e.g., North America). Transmission: *Culex* mosquitoes, possibly *Aedes* and others. Often asymptomatic, includes inflammation of brain, spinal cord, meninges, headache, fever, convulsions, paralysis, coma

Tick-borne:

183. [ROCKY MOUNTAIN SPOTTED FEVER](#)

Rickettsial disease caused by *Rickettsia rickettsii*; spread by **ticks**, this agent is the cause of a potentially fatal human illness in North and South America. Ticks must normally attach 4-6 hours before transmitting the disease, so their prompt removal can prevent disease.

184. [TULAREMIA](#)

A disease of humans and animals (especially **rabbits**, hares, and rodents) caused by the bacterium *Francisella tularensis* spread by **ticks and deer flies**, as well as **inhalation, ingestion**, and skin **contact** with infected animals

185. **LYME DISEASE**

A **spirochete** (*Borrelia burgdorferi*, and *Borrelia mayonii*) found in deer and mice; spread to humans from the bite of **ticks** (*Ixodes* genus) off for ½ life; symptoms: flu-like, fever, rash (bulls-eye pattern), arthritis controls: control the ticks! Stay on trails when hiking; use repellants; stay covered whenever possible: inspect for ticks frequently; remove ticks using a tweezer on the mouth parts, with a steady pull.

Mite-borne:

186. [SCRUB TYPHUS](#)

A **rickettsial** disease caused by *Rickettsia tsutsugamushi*, spread by larval **mites** (chiggers)

Flea-borne:

187. **BUBONIC PLAGUE**

One of three types of plagues (along with **pneumonic and septicemic**) caused by ***Yersinia pestis***, spread by the bite of the **Oriental Rat Flea** (*Xenopsylla cheopis*), mostly from rats; "buboes" refers to swollen **lymph nodes** from the disease

188. **PNEUMONIC PLAGUE**

One of three forms of plague (along with bubonic and septicemic) spread by the **respiratory** route, and is especially **virulent** (i.e., deadly)

189. **TYPHUS FEVER**
Rickettsial diseases spread by **arthropods** (ticks, lice, mites, fleas) often from other animals (rats, cats, opossums, raccoons, etc.)
190. **EPIDEMIC TYPHUS**
Rickettsial disease caused by *Rickettsia prowazeki*; spread by body **lice**
191. **MURINE TYPHUS**
Also called endemic typhus or jailhouse fever; **Rickettsial** disease caused by *Rickettsia typhi*; spread by the Oriental Rat flea (carried by rats)
192. **ZOOMOSES:**
Diseases and infections transmitted between vertebrate animals and humans
193. **LEPTOSPIROSIS**
A **spirochete** spread by animal **urine** (especially rats) in water (also known as **Weil's** disease)
194. **RABIES**
Viral disease with **neurological effects** spread through the salivary glands of **skunks, bats, foxes, dogs, and cats**

CHAPTER 5. PESTICIDES

195. **INORGANIC PESTICIDES**
Includes some of the oldest known pesticides, including boric acid, and silica gel
196. **BORIC ACID**
An inorganic pesticide acting as a stomach poison, used mostly to kill cockroaches
197. **SILICA GEL**
A desiccant (drying agent) that kills insects by cuticular abrasion
198. **BOTANICAL PESTICIDES**
Natural insecticides from plants
199. **PYRETHRUM, PYRETHROIDS**
A plant that contains natural pesticides, or the synthetic forms of pyrethrum
200. **ROTENONE (ROTENOIDS)**
Derris plant that contains natural pesticides, or synthetic forms of the active ingredients
201. **NICOTINE (NEO-NICOTINOIDS)**
Tobacco plant that contains natural pesticides, or synthetic forms of the active ingredients
202. **CHLORINATED HYDROCARBONS**
Any compound containing **chlorine**, hydrogen, and carbon; tend to be relatively **low in acute human toxicity** but highly **persistent** in the environment (**e.g.**, pesticides such as **DDT**)
203. **ORGANOPHOSPHATE PESTICIDES**
Any compound containing **phosphorus**, oxygen, and carbon; tend to be relatively **high in human toxicity** but relatively **low in persistence** in the environment (**e.g.**, parathion)
204. **MALATHION**
A pesticide different from other organophosphates in that it has relatively **low toxicity in humans**

205. **CARBAMATE PESTICIDES**
Pesticides containing nitrogen, oxygen, and carbon (e.g., **baygon and aldicarb**)
206. **BAIT SHYNESS**
Rodents **avoid some rodenticides** more than others, which reduce the rodenticide's effectiveness (e.g., if a rodent survives a small dose of a quick kill rodenticide, it will avoid that bait, and pass along that behavior to its offspring)
207. **ANTICOAGULANTS**
Rodenticides (e.g., warfarin) that are not quick kill, but eventually kill rodents (through multiple doses) as a result of **internal bleeding**; the slower killing is an advantage because it reduces bait shyness; this explains why the most toxic rodenticides are not always the most effective
208. **QUICK KILL RODENTICIDES**
Highly toxic to **humans** as well as rodents (e.g. Strychnine, 1080, 1081, Cyanide) , but low in persistence.
209. **EMETIC**
A substance that can induce vomiting
210. **RED SQUILL**
A rodenticide with cardiac effects used to control *Rattus norvegicus*; it acts as a natural emetic, and is relatively safe in humans, while toxic to rats (i.e., *Rattus norvegicus* cannot vomit)
211. **INTEGRATED PEST MANAGEMENT**
A broad-based approach to pest control that integrates **pesticides** with **other practices** for the economic control of pests (e.g., quarantine, pheromones, juvenile hormones, autocide)
212. **SELECTIVE PESTICIDES**
e.g., Norbromide: low toxicity to humans, highly toxic to *Rattus* genus, but "bait shyness" can occur
213. **QUARANTINE**
Control movement of fruits / vegetables across borders.
214. **GAMBUSIA AFFINIS**
Freshwater guppy that eats mosquito **larvae**; also called **mosquitofish**; other natural predators of mosquitoes include birds, spiders, bacteria (e.g., *Bacillus thuringiensis*), and viruses
215. **ANTIFEEDANTS**
Chemicals that discourage insects from feeding
216. **PHEROMONES**
Sex attractants (for insects); used for controlling insects by attracting them to traps, and confusing the males in locating females
217. **JUVENILE HORMONES**
Chemicals required for **development** (e.g., for insect eggs to hatch); the wrong concentration at a critical time prevents further development of the insect
218. **AUTOCIDE**
Insect **sterilization** (usually by ultraviolet radiation)
219. **FEDERAL INSECTICIDE FUNGICIDE AND RODENTICIDE ACT**
Also called FIFRA; federal law that **registers** pesticides, and requires **testing** of pesticides

220. **TOXIC SUBSTANCES CONTROL ACT**
Also called TOSCA; EPA authority to require **reporting, record-keeping, testing and restrictions** of toxic chemical substances/mixtures. The law is designed to identify risks at the earliest stages of production.
221. **LABELING OF PESTICIDES**
In order of toxicity: **Danger, Warning, Caution**
222. **CERTIFIED PEST CONTROL OPERATOR**
Must have this certification to use pesticides with the label of **danger**
223. **DANGER**
Signal word for pesticides with **highest** risk; also known as a **restricted use** pesticide, which requires a **certified pest control operator** for its use
224. **WARNING**
Signal word for pesticides of **moderate** risk
225. **CAUTION**
Signal word for pesticides of **lowest** risk

CHAPTER 6. SOLID WASTE

226. **WASTE**
A **discarded** material; the EPA definition of solid waste excludes nuclear wastes, agricultural wastes returned to the soil, and mining wastes returned to the mine, all because these wastes are addressed by separate legislation; solid waste is best measure by weight, not volume, because the volume is compacted over time.
227. **GARBAGE**
Relatively **decomposable** waste
228. **RUBBISH**
Relatively **non-decomposable** waste
229. **PUTRESCIBLE**
Decomposable (referring to garbage)
230. **SOURCE REDUCTION**
A process that re-evaluates and **eliminates** waste **generation**
231. **INCINERATION**
Controlled combustion of waste at the optimal temperatures of **1400-1800 deg. F**
232. **MASS BURN**
Incineration where none of the wastes are sorted (i.e., everything is burned)
233. **CONTINUOUS INCINERATION**
A process where wastes are incinerated 24 hours per day; in contrast, **batch incineration** is the burning of a single batch of waste (in less than 24 hours), which is actually less desirable due to additional air pollutants generated during the heating up and cooling down of the incinerator.
234. **PYROLYSIS:**
Burning wastes with no added oxygen (i.e., "roasting"), which produces a charcoal-like material
235. **COMPOSTING:**

Controlled biodegradation of plant and animal matter, resulting in production of humus

236. **HUMUS:**
Decomposed plant and animal matter, especially from composting;
a good soil conditioner (but a poor fertilizer)
237. **WINDROW METHOD**
Commercial method of composting, featuring long rows of compost
238. **RESOURCE RECOVERY**
Any process in which materials are **recovered** rather than discarded; includes reclamation, reuse, and recycling (see below)
239. **RECLAMATION**
(Also called utilization) select materials from solid waste, and use it in **new** ways compared to its original use
240. **REUSE**
Select materials from solid waste, and use it again in the **same way**
241. **RECYCLING**
Use **raw material** from solid waste in various ways
242. **TIPPING FEES:**
Charges to dump garbage at a disposal site (usually in dollars per ton); tipping fees influence the entire economy of solid waste management, because higher fees open up alternatives to landfills
243. **SANITARY LANDFILL**
An area to dispose of solid wastes that features **protective lining, 8-10 feet** layers of waste at a time, and **cover material**
244. **LINER SYSTEMS**
A low permeable barrier laid down under engineered landfill sites; until it deteriorates, it **retards migration** of leachate into underlying aquifers or nearby rivers; modern landfills require a layer of **compacted clay** with a minimum required thickness, overlaid by a **high-density polyethylene** geomembrane
245. **DAILY COVER**
At least **6 inches** of compacted soil on top of the waste at the end of the day; this prevents feeding by birds, insects, etc.
246. **FINAL COVER**
Upon closure of a landfill, a minimum of **24" in depth**
247. **LEACHATE**
In landfills, dissolved materials from the waste itself, or from **water entering landfill**
248. **LANDFILL GAS MONITORING/CONTROL**
If landfill gas is greater than **5% methane**, it presents a **fire hazard**; due to microbes, the oxygen in waste is used up over time, and the resulting anaerobic conditions encourage the growth of methane producing bacteria. The transition to these anaerobic conditions depends on the waste's temperature, pH, and other conditions.
249. **GROUND WATER MONITORING**
All landfills are required to monitor the underlying groundwater for contamination during their **active life and post-closure** care period

CHAPTER 7. HAZMAT / HAZ WASTE

250. D-LIST HAZARDOUS WASTES

Hazardous wastes categorized by their **characteristics**, including ignitable, corrosive, reactive, and toxic (see below)

251. **IGNITABLE**

Defined by flash point < 140 deg. F (see below)

252. **FLASH POINT**

Lab test that heats waste to 140 deg F, places a cup above the waste to **collect vapors**, and an **ignition source** placed near the cup; a brief **burst of light** indicates a positive flash point

253. **CORROSIVE WASTE**

Defined by wastes with a pH less than 2, or greater than 12.5

254. **REACTIVE WASTE**

Explosiveness and toxic by-products from chemical reactions (e.g., TNT)

255. **TOXIC WASTE**

Measured by **standard extraction procedure** for HW; if the liquid extracted from the waste is at a toxic level (set by EPA and risk assessments), the waste is considered a toxic waste

256. MIXTURE RULE FOR HW

The wastes listed below (F, K, U, and P-list wastes) are not allowed to be diluted; These listed hazardous wastes (HW) cannot be combined with non-HW – the resulting mix is **all** considered HW; the purpose of this rule is to discourage the act of diluting HW, rather than treating it appropriately

257. **F-LIST HAZARDOUS WASTES**

Non-specific sources of hazardous wastes classified by generic processes e.g., degreasing operations

258. **K-LIST HAZARDOUS WASTES** Specific sources of hazardous wastes classified by type of industry (e.g., the explosives industry)

259. **U-LIST HAZARDOUS WASTES**

"Toxic wastes" (subject to numerous qualifications)

Remember, the law does not allow these wastes to be diluted

260. **P-LIST HAZARDOUS WASTES** **Acute** hazardous waste subject to **stricter constraints** due to its higher toxicity

261. **UNIVERSAL WASTE**

Common hazardous wastes, (e.g., batteries, pesticides, mercury-containing equipment and bulbs)

262. **HEAVY METALS**

A metal with a high atomic weight, density, or atomic number (e.g. arsenic, cadmium, lead, mercury, and hexavalent chromium); some metals are essential for human nutrition in trace amounts (e.g. copper, zinc, manganese, and iron) but are toxic at higher amounts

263. SQG

Small Quantity Generators (<1000kg/yr), who are subject to different restrictions than the larger generators.

264. **RCRA**
Resource Conservation and Recovery Act; a federal law governing the management of hazardous wastes; the highest priority in this law is given to **source reduction**
265. **CHEMTREC (CHEMICAL TRANSPORTATION EMERGENCY CENTER)**
Information on handling of spills offered by the Chemical Manufacturers Association
266. **CERCLA**
Comprehensive Environmental Response, Compensation and Liability Act; also called "Superfund"; federal law governing illegal hazardous waste sites
267. **RQ (REPORTABLE QUANTITY)** The minimum amount of a hazardous waste spill that is reportable; the higher the toxicity, the lower the reportable quantity
268. **NCP (NATIONAL CONTINGENCY PLAN)**
The overall plan for managing Superfund sites
269. **CERCLIS:**
Comprehensive Environmental Response, Compensation, and Liability **Information System** (an inventory, often a prelude to being placed on NPL)
270. **HRS (HAZARD RANKING SYSTEM)**
System used to **rank** superfund sites, based on the highest risks.
271. **NPL (NATIONAL PRIORITY LIST)**
A list maintained by the U.S. Environmental Protection Agency (EPA) of inactive hazardous waste sites; the list is produced and updated periodically by the EPA; also known as "**Superfund**"
272. **HW MANIFEST**
A **record** of hazardous wastes from the generation to transport to treatment, storage, and disposal facilities (TSD – see below)
273. **TSD FACILITY**
Treatment, storage, and disposal facility for hazardous wastes
274. **SARA**
Superfund Amendment and Reauthorization Act ("Superfund Law"); amendments to CERCLA
275. **ATSDR:**
Agency for Toxic Substance and Disease Registry; a branch of the Public Health Service that investigates health effects at sites (using "**health assessments**") and writes the **toxicological profiles** for chemicals commonly found at Superfund sites.
276. **EPCRA**
The Emergency Planning and Community Right to Know Act; Title III of SARA.
277. **TPQ**
Threshold planning quantity; the **minimum quantity** for a given chemical that **requires notification** to the State Emergency Response Commission under EPCRA; the difference between TPQ and RQ is that TPQ is not a hazardous waste, but for any material stored or used by a facility
278. **TRI**
Toxic release inventory; a **database** of toxic substances that are above the **TPQ**; this database is collected under EPCRA

CHAPTER 8. WATER I

279. **HYDROLOGIC CYCLE**
The **movement of water** around the planet, which depends on such processes as evaporation, transpiration, precipitation, watershed runoff, and percolation (see below)
280. **EVAPORATION**
To change to a vapor state; the **basis of precipitation** and the hydrologic cycle
281. **TRANSPIRATION**
To give off water vapor through **animal or plant pores**
282. **PRECIPITATION**
Rain, hail, sleet, snow, dew
283. **WATERSHED RUNOFF**
Water flowing **across land** to receiving water; includes urban and agricultural sources
284. **PERCOLATION**
A natural process where water **filters through** the soil; the soil acts as a filter to remove suspended solids in water.
285. **LEACHING**
As water moves through soils or landfills, chemicals in the soil may **dissolve** into the water, thereby contaminating the groundwater; percolation **removes** contaminants from water, while leaching **adds** contaminants to water
286. **DISSOLVING**
Solids passing into solution
287. **CAPILLARITY**
Surface attraction between liquids and solids (capillarity helps retain water at the surface)
288. **GROUNDWATER**
Any water located **under the earth's surface** (in the pores and crevices of rock, sand, and soil), which includes some of the highest quality of drinking water (these sources are being depleted), also called aquifer (see below)
289. **AQUIFER**
An underground source of water in a layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand, or silt), and from which **groundwater** can be extracted using a water well
290. **ZONE OF AERATION**
A porous area of groundwater with no free standing water (includes capillary water); also called the **vadose** zone
291. **ZONE OF SATURATION**
A layer of underground sand, gravel, or porous rock that is **saturated** with water; also called aquifer (Latin for "water carrier")
292. **POROSITY**
The amount of water held by soil.
This amount is expressed as a % of the total volume. For example, if there are 100 cubic meters of an aquifer that has porosity of 50%, then we would have 50 cubic meters of water in this aquifer.
293. **WATER TABLE**
The **top** of the zone of saturation; also called the **phreatic surface**; as groundwater get used up, the

water table tends to drop further below the surface, making it hard to reach the water

294. **SURFACE WATER**

Any water available at the earth's surface, and not underground (e.g., rivers, streams, creeks, lakes, reservoirs, wetlands, oceans)

295. **LIMNOLOGY**

The study of **lakes**

296. **OLIGOTROPHIC LAKE**

A **young** lake with low levels of nitrates and phosphates

297. **MESOTROPHIC LAKE**

A **medium aged** lake with moderate levels of nitrates and phosphates

298. **EUTROPHIC LAKE**

An **old** lake with high levels of nitrates and phosphates

299. **EUTROPHICATION**

The natural **aging** of a lake (literally: "new nourishment"); the aging process is natural and slow, but can be greatly accelerated by pollution (especially increased levels **of nitrates and phosphates**)

300. **EPI LIMNION**

Top layer of a lake or reservoir

301. **METALIMNION**

Middle or **transition layer** of a lake or reservoir

302. **THERMOCLINE**

Area of the metalimnion with the **largest temperature change**

303. **HYPOLIMNION**

Bottom zone of stagnation in a lake or reservoir (where **temperatures are lowest** in the summer)

CHAPTER 9. WATER II

304. **REVERSE OSMOSIS**

A process that uses **pressure** to force water molecules across a membrane of **microscopic pores** that prevent contaminants from passing through (i.e., water under pressure moves across a membrane from higher to lower concentration of contaminants). The net result is a removal of contaminants; this process is typically followed by an activated carbon filter.

305. **CHLORINATION**

Water treatment designed to kill bacteria, inactivate viruses, and provide a protective residual; may be **solid** (calcium hypochlorite), **liquid** (sodium hypochlorite, or bleach), or **gaseous** (Cl₂). The killing power from chlorination is derived from the free available chlorine, and not from hydrochloric acid.

306. **FREE RESIDUAL CHLORINE**

Also called free available chlorine or free chlorine; consists of hypochlorous acid and hypochlorite ion

307. **HYPOCHLOROUS ACID**

HOCl (part of free chlorine, and the most effective constituent as a bactericide)

308. **HYPOCHLORITE ION**

OCl⁻ (part of free chlorine)

309. **pH AND CHLORINE**
Lower pH helps maintain an effective level of HOCl
310. **COMBINED CHLORINE**
Chlorine that combines with various chemicals, especially **chloramines**
311. **BREAKPOINT CHLORINATION**
Standard practice for traditional water treatment; confirmed when any added chlorine becomes free chlorine; also confirmed when the **chlorine demand** becomes zero
312. **ALTERNATIVES TO CHLORINATION**
Ozonation, chloramines, bromine/iodine, ultraviolet, boiling, proprietary methods (see below)
313. **OZONATION**
An effective disinfectant that leaves **no protective residual**, and must be generated on site
314. **ULTRAVIOLET LIGHT**
A physical disinfectant in water that leaves no residual; its effectiveness depends on the **turbidity** of the water; viruses tend to be resistant to U.V. treatment
315. **IODINE**
A disinfectant for water that has limited reaction with organics; more cost effective with small scale applications
316. **COMMON CONTAMINANTS IN DRINKING WATER REGULATED BY THE EPA**
While the list continues to grow, some of the more common contaminants are listed below
317. **ARSENIC**
Carcinogenic; other effects include dermatological, developmental, neurological, respiratory, cardiovascular, immunological, endocrine, and gastrointestinal
318. **CADMIUM**
Affects kidneys, adds to **hypertension**
319. **CHROMIUM**
Nutritional when in trivalent form (+3), affects liver and kidneys when **hexavalent** (+6)
320. **LEAD**
Affects GI, dermatitis, and **central nervous system**
321. **MERCURY**
Effects discovered in the Minamata bay in Japan ([Minamata disease](#)), contamination was mostly from the **organic** form of mercury moving up the food chain
322. **METHEMOGLOBINEMIA**
A condition associated with **nitrites** in water (and various other agents), nitrites in the body ultimately convert hemoglobin to a form that cannot carry oxygen reversibly
323. **BARIUM**
A **muscle stimulant** leading to **cardiovascular** effects
324. **FLUORIDES**
Fluorides prevent dental caries (**cavities**) at appropriate levels, but cause **mottling** (discoloration) at higher levels and **skeletal effects** (brittle bones) at even higher levels

325. **SILVER**
Silver causes **argyrosis** (discoloring of eyes, skin, and mucous membranes)
326. **SAFE DRINKING WATER ACT (SDWA)**
The federal law that protects public drinking water supplies, and sets standards for drinking water quality
327. **PRIMARY STANDARDS**
Water standards based on **health effects**; these laws are **federally enforceable**; (e.g., arsenic, cadmium, chromium, lead, mercury, nitrates, barium, fluorides, silver)
328. **SECONDARY STANDARDS**
Water standards based on **aesthetics** (taste, odor, appearance); these laws are **guidelines** to states; (e.g., **iron and manganese**, which have little or no health effects). Secondary standards for drinking water are not federally enforceable.

CHAPTER 10. WASTEWATER / SOILS

329. **SOURCES OF WASTEWATER**
Point sources: discrete and identifiable sources of wastewater
Domestic: from homes and small businesses (collection/transport is the most difficult)
Industrial: from a wide range of industries (often the hardest to treat)
Non-point sources: diffuse sources of wastewater (generally from runoff)
Agricultural: runoff from agriculture (the largest source of wastewater)
Urban runoff: stormwater systems that are often not treated but returned to the ocean, etc.
Atmospheric: air pollution picked up by precipitation
330. **CARRYING CAPACITY**
The ability of a natural ecosystem to absorb wastes and purify itself; this may also refer to the ability of a species to absorb wastes and survive indefinitely; when humans produce wastewater above the carrying capacity, this amount can destroy an ecosystem, thus requiring wastewater treatment
331. **TOTAL SOLIDS CONTENT**
The residual matter in wastewater that remains after evaporation at about 103-105 deg C (i.e., **boiling** off the water, and weighing the remaining residual)
332. **TOTAL SUSPENDED SOLIDS (TSS)**
Solids more than 1 micron in diameter; the dry-weight of particles trapped by a filter; includes settleable solids; also called **non-filterable** residue
333. **SETTLEABLE SOLIDS**
Solids in wastewater that settle (by gravity) in **1 hour**
334. **FILTERABLE SOLIDS**
Less than 1 micron in diameter, includes dissolved and colloidal solids, cannot be removed by gravity
335. **COLLOIDS**
1-100 milli-microns; small particles that **remain suspended** in solution
336. **DISSOLVED SOLIDS:**
This generally includes wastes less than 1 millimicron in diameter.
337. **BOD (BIOLOGICAL OXYGEN DEMAND)**
A measure of the dissolved **oxygen** used by **microbes** in the biochemical oxidation of **organic** matter, usually for a period of 5 days; it is the most **relevant** measure for designing secondary wastewater

treatment plants, because these facilities rely on microbes that use oxygen to break down organics; BOD reflects **biodegradable** wastes

338. **COD (CHEMICAL OXYGEN DEMAND)**

A measure of dissolved oxygen used by an oxidizing agent (**potassium dichromate**) in the oxidation of **organic matter** over **3 hours**; COD is usually higher than BOD for a given waste, reflecting the difference between biodegradable and non-biodegradable waste

339. **TOD (TOTAL OXYGEN DEMAND)**

A method used to measure organics in wastewater by injecting the wastewater into a platinum catalyzed **combustion** chamber, then measuring the **oxygen** before and after combustion; it is the quickest measure of organics in water

340. **TOC (TOTAL ORGANIC CARBON)**

The **carbon dioxide** produced by combustion of organics in water

341. **SOIL**

Soils are made of combinations of three different grains: sand, silt, and clay (see below)

342. **SAND**

coarse grained component of soils (> .05 mm)

343. **SILT**

medium grained component of soils (.05 - .002 mm)

344. **CLAY**

fine grained component of soils (< .002 mm)

345. **LOAM**

A combination of all the above: **40% silt, 40% sand, 20% clay.**

346. **CHEMICAL CONTENT OF SOIL**

On average, the most abundant elements in soil (in order): oxygen, silicon

347. **HUMUS**

The organic content of soil

348. **INFLUENT**

Any fluid that **flows into** a treatment process (e.g., primary influent flows into primary treatment)

349. **EFFLUENT**

Any fluid that **flows out** of a treatment process (e.g., secondary effluent flows out after completion of secondary treatment)

350. **PRELIMINARY WASTEWATER TREATMENT**

Treatment **before** entering primary treatment; e.g., bar screens and racks, comminuter, grit chamber, skimming tank, holding tanks – see below)

351. **SCREENING**

Preliminary treatment of wastewater that removes large solids that can then be ground up, or treated as a solid waste

352. **COMMINUTER**

Machines that grind or shred large solids in wastewater (for better digestion downstream)

353. **GRIT CHAMBER**
Preliminary treatment of wastewater (with **1 minute** detention time) that removes the solids that can settle quickly (i.e., grit)
354. **SEDIMENTATION**
This process is used in both primary and secondary wastewater treatment, it takes place when there is **gravitational settling** of particles to the bottom of a tank (also called settling).
355. **SLUDGE:**
Any solid, semisolid, or liquid waste that settles to the bottom of sedimentation tanks (in wastewater treatment plants or drinking water treatment plants, or septic tanks)
356. **PRIMARY WASTEWATER TREATMENT**
Mechanical removal of wastes from water; does not remove most of the organics (BOD) or total suspended solids (TSS)
357. **SECONDARY WASTEWATER TREATMENT**
Biological (microbial) treatment of wastewater; removes most of the organics (BOD) (e.g., trickling filters, activated sludge, rotating biological contactors, intermittent sand filters – see below). Secondary (which is more effective than primary treatment) is now required under the Clean Water Act
358. **ACTIVATED SLUDGE**
Secondary treatment of wastewater that **recycles** a portion of the sludge back into treatment to optimize aerobic microbial digestion; the key processes depend on aerobic microbes and oxygen
359. **TRICKLING FILTERS**
Secondary treatment of wastewater (uses action of bacteria). Despite its name, it is not filtration
360. **WASTE STABILIZATION PONDS**
Extended retention of treated wastewater; may be aerobic, facultative, or anaerobic, also called **lagoons**
361. **TERTIARY WASTEWATER TREATMENT**
Physical and chemical treatment of wastewater; frequently makes use of methods normally applied to **drinking water** (e.g., ion exchange, ultraviolet, and ozone disinfection)
362. **SEPTIC SYSTEMS**
(Also called septic tank systems). A self-contained, underground wastewater treatment system based on a **septic tank** and **tile field**; it treats wastewater onsite, and is often more economical than centralized sewer systems in **isolated and rural areas**
363. **SEPTIC TANK**
A **watertight tank** used to store wastewater for a minimum retention time of **24 hours**, which breaks up the solids and allows for better introduction of the wastes into a tile field; septic tanks by themselves do not digest the waste to any significant degree, but they condition the sewage for digestion downline, where the waste is received and digested by the soil (tile field)
364. **TILE FIELD**
An area of soil where water from a septic tank is **drained** at a rate where **soil microbes** can digest the waste; also called **absorption field, leach field, or trenches**; the distribution pipes in the tile field have holes in them for even draining of the wastewater in the tile field; the permeability of the soil in the tile field is a key variable in the design of tile fields
365. **PERC TEST**
A method to determine the **absorption rate of a leach field** (part of a septic tank system): 1) dig a hole about a **yard deep**, 2) saturate with water, and 3) measure the drop in the water line in **minutes per inch** (also called the perc number); a **large** perc number means **tight soils**

366. **BLACK WATER**
Wastewater with **fecal** wastes

367. **GRAY WATER**
Wastewater **without** fecal wastes

CHAPTER 11. INDUSTRIAL HYGIENE

368. **INDUSTRIAL HYGIENE**
The study of workplace hazards (anticipating, recognizing, evaluating, and controlling hazards)

369. **TWA (TIME WEIGHTED AVERAGE)**
Occupational **exposures averaged** over time (usually **8 hour workday**); OSHA uses it to determine permissible exposure limits (**PELs**); e.g. $(C_1T_1 + C_2T_2 + \dots)/8$ hours; where: C = concentrations; T = time (where T's sum to 8 hrs.)

370. **PERSONAL PROTECTION EQUIPMENT AND PROCEDURES (PPE)**
Hard hat; other protective headgear; Ear plugs; Gloves; Goggles; Safety shoes, Sun protection, Insect repellent

371. **HEAT STRESS**
A medical emergency when the body's temperature regulation fails and body **temperature rises** to critical levels; prevention includes staying **hydrated** (drinking water) and avoiding the source of heat

372. **CONFINED SPACES**
Any area with limited or restricted means of **entry or exit**, not designed for continuous occupancy; prevention includes: recognition of the hazard, equipment for testing and monitoring, adequate air supply, rescue plans for emergencies

373. **TRENCH SHORING**
Bracing the walls of a trench to prevent collapse

374. **SDS (SAFETY DATA SHEETS)**
Formerly MSDS (material safety data sheets); **health and safety information on various chemicals**; includes instructions for safe use and potential hazards from a particular material or product; possible health and safety hazards of a product, and how to safely store, use and handle the product

375. **ERGONOMICS**
The study of people's efficiency in their working environment, including **office safety, repetitive motion**, especially to prevent **Musculoskeletal Disorders** (MSDs) (e.g., carpal tunnel syndrome)

376. **DECIBELS**
A **logarithmic** scale used to measure the intensity of a sound

377. **dba**
Decibel A scale, designed to measure how humans **perceive** loudness in normal situations

378. **SOUND LEVEL METER**
An instrument used for noise measurement; amplitude measures how forceful the wave is, **measured in decibels** or dBA of sound pressure; **0 dBA** is the softest level that a person can hear

379. **NOISE**
Unwanted sound

380. **NOISE CONTROLS**
e.g., acoustical wall and ceiling panels, shock mounting of source equipment, acrylic glass or other solid barriers, ear protection equipment
381. **PRESBYCUSIS**
Loss of hearing with **age**
382. **SOCIOCUSIS**
Loss of hearing from noise in the **social environment** (not including occupational, age, or disease).
383. **TEMPORARY THRESHOLD SHIFT**
Hearing loss that is **recoverable** over time
384. **PERMANENT THRESHOLD SHIFT**
Hearing loss that is **permanent**
385. **OSHA STANDARD FOR OCCUPATIONAL NOISE**
Permissible exposure level of **90 dB for 8 hours**
386. **CAL-OSHA STANDARD FOR OCCUPATIONAL NOISE**
Permissible exposure level of 85 dB for 8 hours
387. **PEL (PERMISSIBLE EXPOSURE LEVEL)**
Set by OSHA, the enforceable occupational exposure limits, based on **8-hr TWA**
388. **IDLH (IMMEDIATELY DANGEROUS TO LIFE OR HEALTH)**
Exposure to airborne contaminants that is "likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment"
389. **ENGINEERING**
Remove hazards through process change, chemical substitution, ventilation, shielding, or guarding; **requires little or no employee action**
390. **GUARDING**
Use of any device designed to keep **any part of a worker's body** out of the **danger zone** of a machine during its operating cycle
391. **ADMINISTRATIVE CONTROLS** **Manage exposure** by worker rotation, procedures, training, trench shoring, and controlled access areas; **requires employee action**
392. **HOUSEKEEPING**
Having **no unnecessary items** in the workplace, and keeping all necessary items in their proper places; includes proper cleaning, control of dust, disposal of wastes, and clean-up of spills
393. **BEI (BIOLOGICAL EXPOSURE INDICES)**
Guidance values from ACGIH for assessing **biological monitoring** result (blood, urine, etc.)
394. **AL (ACTION LEVEL)**
The concentration of a harmful substance which requires **medical surveillance**, increased industrial hygiene **monitoring, or biological monitoring**; generally set by **OSHA** at **half of the PEL**
395. **REL (RECOMMENDED EXPOSURE LIMIT)**
Levels recommended by **NIOSH** for adoption as a PEL by OSHA; not legally enforceable, widely considered in developing PEL's

396. **TLV ([THRESHOLD LIMIT VALUE](#))**
Issued by **ACGIH**, the level a worker can be exposed to a chemical **day after day** for a working lifetime without adverse health effects; not intended as legal standards
397. **EXPOSURE VALUES**
The airborne concentrations of a biological, chemical, or physical agent to which nearly all workers may be exposed **without harmful effects**
398. **CEILING**
Absolute **maximum level** of exposure not to be exceeded (instantaneous limits)
399. **STEL ([SHORT-TERM EXPOSURE LIMIT](#))**
Approved exposures during a short period, usually **15 minutes**, designed to limit higher level short-term exposures
400. **INCIDENT**
An unwanted event which could have resulted in harm to people, damage to property or loss to a process; also known as a **near miss**
401. **BREATHING ZONE**
The area surrounding the **worker's head**; the air in this area represents the air breathed in by the worker
402. **DANGER ZONE**
An **area** or location where the **probability of injury is high** (e.g., in the vicinity of saw blades)
403. **GENERAL DUTY CLAUSE**
Even if not listed explicitly in the law, places of employment must be **free from recognized hazards**, which allows enforcement based on **general principles** of industrial hygiene

CHAPTER 12. RADIATION

404. **RADIATION**
Energy emitted from a **source**; energy that **travels** (e.g., sound, light, X-rays, etc.)
405. **ION**
A charged atom (i.e., with a different number of **electrons** and protons)
406. **[FREE RADICAL](#)**
An unpaired **electron** (extremely reactive)
407. **ISOTOPE**
Any atom with a number of neutrons that is altered from its "normal" state
408. **RADIOISOTOPE**
Altered # of **neutrons** in the nucleus (compared to an element's normal state)
409. **[IONIZING RADIATION](#)**
Radiation of sufficient **energy** to ionize the atoms around it (e.g., alpha, beta, gamma, X-rays, and neutrons -- see below)
410. **ALPHA PARTICLES**
Particles made of **2 neutrons and 2 protons** (the equivalent of a helium atom stripped of its electrons); little penetrating power, normally a hazard only in the form of internal radiation received through ingestion, inhalation or open wounds

411. **BETA PARTICLES**
Electrons from disintegrations within the **nucleus**; blocked by glass or plastic
412. **GAMMA RADIATION**
Electromagnetic radiation from the **nucleus** (an indirectly ionizing radiation)
413. **X-RAY**
Electromagnetic radiation from the **electrons** (an indirectly ionizing radiation)
414. **NEUTRONS**
An indirectly ionizing radiation
415. **RADIATION MEASUREMENTS**
Radiation is measured by the source (Curie, Becquerel), through air (Roentgen, Exposure unit), absorption (RAD, Gray), and biological equivalent (REM, Seivert) – see units below
416. **CURIE**
Rate of disintegration from **one gm of natural radium-226/second**; a measure of source radiation
PICOCURIE: A **trillionth** of a curie = 2.2 disintegrations/second
417. **BECQUEREL**
1 disintegration per second of radioactive material; a measure of source radiation
418. **ROENTGEN**
2.09* 10⁹ **ion pairs** (+/-)/cc of dry air, measure of radiation in air
419. **EXPOSURE UNIT**
1 **coulomb/kg**; measure of radiation in air
420. **RAD**
Radiation Absorbed Dose = 100 **ergs/gram** of absorbing material; the median lethal dose for acute radiation is about 300 to 500 RADs (for X-rays, that would be 300 to 500 REMs)
421. **GRAY**
100 RADs
422. **RBE**
Relative biological effectiveness; also known as quality factor (QF); used to convert RADs to REMs
423. **REM**
Roentgen equivalent man = **RADs x RBE**; measure of radiation dose equivalent (it is used to measure dose and health impacts). On average, natural radiation (also called background levels) account for about 100 milli-rem/year; artificial sources account for about 80 milli-rem/year (mostly from medical testing)
424. **LET**
Linear energy transfer; amount of energy transferred from radiation per distance travelled
425. **SIEVERT**
100 rem; measure of radiation dose equivalent (it is used to measure dose and health impacts)
426. **COSMIC RADIATION**
Natural radiation from deep space; primary is directly ionizing, secondary is created when hitting the earth's atmosphere; increases with **altitude**, drops in barometric **pressure**, and proximity to magnetic **poles**. Our own sun accounts for only a minor part of cosmic radiation

427. **TERRESTRIAL RADIATION**
Radiation emitted by naturally radioactive materials on earth, including clay, coal, and granite (sources of uranium, thorium, and radon)
428. **NONIONIZING RADIATION**
Radiation that cannot ionize atoms around it, but nevertheless can cause health effects; e.g., U.V., I.R., visible light (as lasers), microwaves, ELF-EMF – see below
429. **U.V. (Ultraviolet)**
Effects include **sunburn**, **skin cancers**, fever, nausea, **cataracts**, and retina damage; [prevention](#) includes sunblock with **SPF** (sun protection factor), shade (e.g. umbrella), and covering the skin (e.g., hats, clothing)
430. **VISIBLE**
Risk in this frequency are from eclipses and lasers (burns hole in retina)
431. **INFRARED**
Effects include burns, cataracts, retina damage; controls include special clothing and shielding.
432. **MICROWAVES**
Reflected by metal, non-ionizing radiation measured by electron volts; effects include **heating** (cooked tissue), interferes with holder **pacemakers**; associated with cataracts, cancer, and birth defects
433. [ELF-EMF](#)
Extremely low frequency electromagnetic fields; exposures from power transmission lines, electric blankets, toasters, hair dryers, T.V., video display terminals, etc.; effects still unclear
434. [BIOLOGICAL HALF-LIFE](#)
Time for living tissue to eliminate, through **biological** processes, **half** of a given amount of substance
435. **RADIOACTIVE HALF-LIFE**
Time for **material** to lose **half** of its radioactivity
436. [EFFECTIVE HALF-LIFE \(E\)](#)
 $E = (B \cdot R) / (B + R)$ where: B = Biological half-life , **and** R = Radioactive half-life
e.g., if B is 4 days and R is 4 days, then effective half life $E = (4 \cdot 4) / (4 + 4) = 2$ days
437. **SOMATIC EFFECTS TO TISSUES**
Radiation effects directly on the **body**, including burns, skin conditions, cataracts, alopecia, cancer, etc.
438. **GENETIC EFFECTS TO REPRODUCTIVE CELLS**
Radiation effects on the **DNA**, leading to health effects such as birth defects
439. **NUCLEAR REGULATORY COMMISSION**
has primary responsibility for regulating nuclear power plants (i.e., "inside the fence")
440. **ALARA**
As low as reasonably achievable; typically used in reference to radiation standards
441. [RADIATION PROTECTION PRINCIPLES](#)
Reduce **Time**, Increase **Shielding** and **Distance**
442. [INVERSE SQUARE LAW](#)
A basic way to lower radiation exposure is to increase the distance between the source and humans. Radiation decreases with the inverse of the **distance** squared (e.g., if the distance is tripled between a

host and a radiation source, their new exposure is the inverse of **3 squared, or 1/9th** of the original exposure); also applies to **light and noise**

443. **HALF VALUE LAYER**

The **thickness** of material that can reduce radiation to half their level

444. **BENEFICIAL APPLICATIONS OF RADIATION**

Radiation has many benefits, including iodine-131 tracers, neutron activation analysis, Americium 241, and carbon dating (see below)

445. **IODINE-131 TRACERS**

Beta radiation with a 1/2-life of about 8 days; used in medicine to study and treat the thyroid (thyroid concentrates iodine); note: 99.9% eliminated in about 80 days

446. **NAA (NEUTRON ACTIVATION ANALYSIS):**

A technique used in criminal investigations -- bombard sample material with neutrons, and then measure frequency and intensity of resultant gamma radiation; also used to measure trace quantities of pollutants (e.g., heavy metals)

447. **AMERICIUM-241**

Alpha radiation with a 1/2-life of about 400 years; used on the end of lightning rods, increases attraction; also used in smoke detectors (ionizes air between two electrodes, which creates current; smoke interferes with current, thereby activating alarm)

448. **CARBON DATING (Carbon-14)**

Carbon-14 is created in air with neutron capture of cosmic radiation; 1/2-life is 5,760 years; the amount of carbon 14 decay can be used to accurately identify the age of material

CHAPTER 13. AIR QUALITY I

449. **AIR POLLUTION**

As established by the U.S. Clean Air Act (CAA), air pollution is **solids, liquids and gases** emitted into the **outdoor** air in amounts injurious to **humans, animals, plants, and property**. Other considerations: the 6 criteria pollutants (see below); most air pollution is mixed (i.e., multiple pollutants); air pollution is associated with increased incidence of sore throats; rain and wind can both decrease and increase pollution, depending on where it moves the pollutants

450. **CRITERIA AIR POLLUTANTS**

As established by the CAA, the 6 air pollutants that stand as an overall indicator of community air quality: **SOx, NOx, CO, particulates, lead, ozone**

451. **NON-POINT POLLUTION**

Diffuse sources of water or air pollution (e.g., mobile sources such as cars into air, or urban and agricultural runoff into water)

452. **PRIMARY POLLUTANTS**

Pollutants emitted from a **source** (e.g., stack or a tailpipe), rather than being created in the atmosphere

453. **SECONDARY POLLUTANTS**

Pollutants created in the **atmosphere**, rather than being emitted from a source (e.g., stack or a tailpipe); photochemical smog contains secondary pollutants

454. **EFFECTS OF AIR POLLUTANTS**
Respiratory diseases, ecological damage (affects biodiversity), architectural deterioration (acid rain), reduced crop production
455. **PARTICULATES**
A criteria pollutant; solid and liquid aerosols in the air; also called aerosols
456. **SMOKE**
Solid particulates < **1 micron** in diameter, created by combustion
457. **DUST**
Solid particulates > **1 micron** in diameter, created mostly by erosion processes
458. **FUMES**
Solid particulates < **1 micron** in diameter, created when the **gases** from burning metals and **coalesce** to form particulates
459. **MIST**
Liquid particulates < **10 microns** in diameter, formed during condensation of vapors, and during various chemical processes
460. **SPRAY**
Liquid particulates > **10 microns** in diameter
461. **PM-10**
Particulate matter less than **10 microns** in diameter, which are significant to health effects; the basis for modern air quality standards for particulates; pm-10 is small enough to reach the alveoli
462. **PM-2.5**
Particulate matter less than **2.5 microns** in diameter
463. **NANOMATERIALS**
Materials 1 nm wide (billionth of a meter), usually includes **1—100 nm**
464. **UFP (Ultra-fine particulates)**
Respirable nanomaterials
465. **SO_x (SULFUR DIOXIDE)**
A primary pollutant, part of the 6 criteria pollutants, created when fuel with **sulfur is combusted**; crude oil that is low in sulfur is called “sweet crude;” higher sulfur content is called “sour crude”
466. **ACID RAIN**
Precipitation with a **pH < 5**; unpolluted rainfall has a pH < 7, due to carbonic acid from carbon dioxide; part of the larger groups of acid precipitation and acid deposition
467. **HYDROCARBONS**
Any compound that contains hydrogen and carbon, including fuels, and emissions from plants and animals; **not a criteria pollutant**, but may contribute to **photochemical smog** if they are volatile;
468. **VOC (VOLATILE ORGANIC COMPOUNDS)**
Any organic chemical that evaporates readily in air; hydrocarbons, especially **aldehydes and ketones**, whose volatility contributes to **photochemical smog**
469. **PAH**
Poly-aromatic hydrocarbons; some are carcinogenic

470. **CARBON MONOXIDE**
An asphyxiant created by incomplete combustion of hydrocarbons
471. **NO_x (NITROGEN OXIDES)**
A primary pollutant, part of the 6 criteria pollutants, created when **high temperatures** of combustion combines nitrogen and oxygen in the air; nitrogen dioxide has a characteristic brown color associated with photochemical smog
472. **OZONE**
Created by photochemical smog: UV radiation splits off an oxygen free radical from nitrogen dioxide, and the oxygen free radical combines with O₂ in the air to form ozone; hydrocarbons also play a role in enhancing ozone formation
473. **CARBON DIOXIDE**
Not a criteria pollutant, created when fuels with are **completely combusted**; global increases have contributed to global **climate change**
474. **PHOTOCHEMICAL SMOG**
Secondary pollution created by chemical reactions in the atmosphere that are driven by **ultraviolet** radiation driven by the sun; consists of ozone and all other oxidants created by photochemical reactions
475. **INVERSION**
A meteorological condition where temperature increases with altitude, which acts to trap pollutants closer to ground level; inversions are often associated with photochemical smog
476. **COPD**
Chronic obstructive pulmonary disease (includes bronchitis, emphysema); poor long-term airflow to the lungs, characterized by shortness of breath and cough

CHAPTER 14. AIR QUALITY II

477. **OZONE**
A criteria pollutant (a secondary pollutant), especially found in **photochemical smog**, subject to **tolerance** (i.e., repeated exposure makes a person more resistant to exposures)
478. **SYNERGISMS**
Particulates and sulfur oxides are synergistic (i.e., they are much more damaging together than separate); smaller particulates adsorb sulfur oxides, thereby increasing penetration into the lungs, with the associated health effects.
479. **CARBON MONOXIDE**
A primary pollutant, part of the 6 criteria pollutants, created when there is **incomplete combustion** of hydrocarbons; an odorless, colorless gas, which can cause sudden illness and death through **asphyxiation**
480. **ASPHYXIAN**
Chemicals that interfere with transport of **oxygen by hemoglobin** in red blood cells (e.g., Carbon Monoxide)
481. **LEAD**
A primary pollutant, part of the 6 criteria pollutants, with a variety of **neurological effects**, as well as anemia and kidney damage; leaded fuel was phased out under the CAA amendments, leading to substantially reduced levels in outdoor air

482. **CAA: CLEAN AIR ACT**
Federal law designed to protect human health as well as the environment from the effects of air pollution
483. **STATE IMPLEMENTATION PLANS (SIP)**
The Federal Clean Air Act requires state plans for achieving air quality
484. **ATTAINMENT AREA**
An area that **meets** the requirements of the NAAQS (Clean Air Act), and is therefore not subject to any additional requirements
485. **NON-ATTAINMENT AREA**
An area that does **not** meet the requirements of the Clean Air Act (NAAQS), and therefore may be subject to additional requirements
486. **PSD (PREVENTION OF SIGNIFICANT DETERIORATION)**
An area designated for **special protection** from air pollution, even if it meets the NAAQS (e.g., national parks)
487. **NAAQS**
National ambient air quality standards for the **6 criteria air pollutants** (SO_x, NO_x, CO, lead, particulates, and ozone); standards are set without regard to cost, and must focus strictly on health effects
488. **AIR QUALITY INDEX (AQI)**
The level of criteria pollutants in ambient air, expressed on a scale of 0 to 500, where 0 = no pollutant, and **100 = 100% of the maximum allowable concentration** (anything above 100 violates the standard)
489. **NEW SOURCE PERFORMANCE STANDARDS**
A section of the Clean Air Act that focuses on **stationary point sources** (e.g., industrial emissions); decisions under this section of the law must weight costs and benefits of controlling different industries.
490. **NESHAPs**
National Emission Standards for Hazardous Air Pollutants; also called **air toxics**
491. **HAZARDOUS AIR CONTAMINANTS**
Air toxics; any of the hazardous air pollutants that are **not part of the criteria pollutants**
492. **LOCAL AIR POLLUTION CONTROL DISTRICT**
Agencies that plan and implement air quality at the regional level; e.g., the SCAQMD and the BAAQMD
493. **INDOOR AIR POLLUTION**
Air quality inside homes, buildings, and structures; issues include fireplaces, space heaters, gas stoves, ventilation fans, etc..
494. **BUILT ENVIRONMENT**
Areas and structures (roads, parks, buildings, homes) that are constructed by human beings (as opposed to natural structures)
495. **FIREPLACES**
Can be significant sources of carbon monoxide, nitrogen oxides, and particulates
496. **SPACE HEATERS**
Gas space heaters are significant sources of carbon monoxide; kerosene heaters are significant sources of sulfur dioxide (and can be deadly in indoor environments).
497. **GAS STOVES**
Can be significant sources of carbon monoxide, nitrogen oxides, and particulates

498. **STANDARD VENTILATION FANS ABOVE STOVES**
Effective at reducing indoor air pollution from stoves, but they have low usage rates.

CHAPTER 15. GLOBAL TRENDS

499. **GLOBAL WARMING**

Warming of average global temperatures due to gases that allow penetration of ultraviolet radiation from the sun, but absorb infrared radiation that would otherwise escape from the planet; the preferred term is climate change (see <https://climate.nasa.gov/evidence/>)

500. **GREENHOUSE GASES**

Any gas that absorbs more IR than UV energy. Global concentrations have increased for four greenhouse gases: **CO₂ (Carbon dioxide)**, **CH₄ (methane)**, **N₂O (nitrous oxide)**, and **fluorinated gases (including CFCs)**.

501. **CONDUCTION**

Heat transfer through **physical contact**; mostly a micro effect (e.g., if you touch a hot oven)

502. **CONVECTION**

Heat transfer by **warmed fluid** (gas or liquid); (e.g., a convection oven has a fan) convection has regional effects on weather, but limited influence on global averages

503. **RADIATION**

Transfer of energy by **electromagnetic waves** (e.g., u.v., i.r.); radiation is critical to analyzing global warming

504. **ISOTOPIC METHODS**

Dating of materials by the half-life of a given isotope (best known example is carbon dating). This has been done for multiple isotopes in multiple settings, including air pockets of Antarctic ice and shell sediments at the bottom of the ocean, giving a more coherent picture of carbon dioxide and warming over the history of planet earth, and confirming current global warming trends.

505. **ALBEDO**

(Light reflected) / (light received); particulates can have a **cooling effect** due to albedo, and must be accounted for in the analysis of global warming

506. **TROPOSPHERE**

The layer of atmosphere **closest** to the earth's surface. This layer is where human exposures occur.

507. **STRATOSPHERE**

The layer of atmosphere **above** the troposphere. This layer is well above the earth's surface, where human exposures do not occur.

508. **CFC**

Chlorofluorocarbons, used in a wide range of propellants, freons, etc., that **break down stratospheric ozone**, especially above the Antarctic; their phase-out led to improvements in stratospheric ozone

509. **STRATOSPHERIC OZONE DEPLETION**

Destruction of ozone, especially by manmade emissions of **CFCs**, that resulted in increased **u.v. radiation** reaching the earth's surface. Elements associated with ozone destruction include **the chlorine free radical** from CFCs (chlorofluorocarbons), **hydroxide free radicals (OH)**, and **nitric oxide (NO)**, but not hydrochloric acid or chlorine nitrate. In the Antarctic spring, chlorine nitrates melt, releasing the chlorine free radical, and with it the seasonal depletion of ozone.

510. HALONS
Materials containing halogens (especially bromine) that are also active in destroying ozone.

511. PARIS CLIMATE ACCORD
U.N. Agreement to reduce greenhouse gas emissions. There are no specific targets for emissions of greenhouse gases for each country, and there are no specific dates for achieving reductions. Instead, each country would develop their own plans to limit their total emissions, to report their progress to the U.N., and to adapt to the adverse impacts of climate change. Under the accord, developed countries would mobilize \$100 billion a year in aid to developing countries to lower emissions of greenhouse gases, from 2020 to 2025.

512. Mitigation
Measures to reduce future climate change by reducing emissions of heat-trapping gases or removing carbon dioxide from the atmosphere.

513. Sink
A natural or technological process that removes pollutants from the atmosphere (e.g. carbon)