



RESOURCE LIBRARY

The Glossary of Environmental Terms is a useful quick reference for laymen wanting to know more about environmental jargon they come across.

Source:

U.S. EPA -ROAD MAP TO UNDERSTANDING INNOVATIVE TECHNOLOGY OPTIONS
FOR BROWNFIELDS INVESTIGATION AND CLEANUP

Adsorption

Absorption is the passage of one substance into or through another.

Or, adsorption is the adhesion of molecules of gas, liquid, or dissolved solids to a surface. The term also refers to a method of treating wastes in which activated carbon is used to remove organic compounds from wastewater. See *also Carbon Adsorption*.

Air Sparging

In air sparging, air is injected into the ground below a contaminated area, forming bubbles that rise and carry trapped and dissolved contaminants to the surface. Air sparging is often used in conjunction with soil vapor extraction systems. See *also Soil Vapor Extraction*.

Air Stripping

Air stripping is a treatment technology that removes or "strips" VOCs from contaminated groundwater or surface water. As air is forced through the water, VOCs are volatilized. See *also Volatile Organic Compound*.

American Society for Testing and Materials (ASTM)

The ASTM sets standards for many services, including methods of sampling and testing of hazardous waste and media contaminated with hazardous waste.

Applicable or Relevant and Appropriate Requirement (ARAR)

As defined under CERCLA, ARARs are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limits set forth under federal or state law that specifically address problems or situations present at a CERCLA site. ARARs are major considerations in setting cleanup goals, selecting a remedy, and determining how to implement that remedy at a CERCLA site. ARARs must be attained at all CERCLA sites unless a waiver is attained. ARARs are not national cleanup standards for the Superfund program. See *also Comprehensive Environmental Response, Compensation, and Liability Act and Superfund*.

Aquifer

An aquifer is an underground rock formation composed of such materials as sand, soil, or gravel that can store groundwater and supply it to wells and springs.

ARAR

CERCLA requires that Superfund remedial actions attain standards that are legally applicable or relevant and appropriate to the circumstances at a given Superfund site. ARARs are used in conjunction with risk-based goals to establish cleanup goals at Superfund sites. ARARs are established on a site-by-site basis, and may include those under federal laws and regulations and those under state and local laws and regulations.

Aromatics

Aromatics are organic compounds that contain 6-carbon ring structures, such as creosote, toluene, and phenol, that often are found at dry cleaning and electronic assembly sites.

Asbestos

Asbestos is a mineral fiber that has been used commonly in a variety of building construction materials for insulation and as a fire-retardant. EPA and CPSC have banned several asbestos products. Manufacturers have also voluntarily limited uses of asbestos. Today, asbestos is most commonly found in older homes, in pipe and furnace insulation materials, asbestos shingles, millboard, textured paints and other coating materials, and floor tiles.

Elevated concentrations of airborne asbestos can occur after asbestos-containing materials are disturbed by cutting, sanding or other remodeling activities. Improper attempts to remove these materials can release asbestos fibers into the air in homes, increasing asbestos levels and endangering people living in those homes

Baseline Risk Assessment

A baseline risk assessment is an assessment conducted before cleanup activities begin at a site to identify and evaluate the threat to human health and the environment. After remediation has been completed, the information obtained during a baseline risk assessment can be used to determine whether the cleanup levels were reached.

BDAT

Under the RCRA Land Disposal Restrictions Program, EPA establishes treatment standards governing specific waste codes that are based on the performance of BDAT. Of the proven, available technologies, EPA designates as BDAT the technology that best minimizes the mobility or toxicity of the hazardous waste constituents of a waste.

Bedrock

Bedrock is the rock that underlies the soil; it can be permeable or non-permeable. *See also Confining Layer and Creosote.*

Best Demonstrated Available Technology (BDAT)

A BDAT is a technology that has demonstrated the ability to reduce a particular contaminant to a lower concentration than other currently available technologies. BDATs can change with time as technologies evolve.

Biodegradability

Biodegradability is the capability of a substance to break down into simpler substances, especially into innocuous products, by the actions of living organisms (that is, microorganisms).

Biopile

Biopile is an aerated static pile composting process in which soil is mixed with amendments on a treatment area that includes leachate collection systems and aeration with blowers or vacuum pumps. It is used to reduce concentrations of petroleum constituents through the use of biodegradation. Moisture, heat, nutrients, oxygen, and pH can be controlled to enhance biodegradation.

Bioremediation

Bioremediation refers to treatment processes that use microorganisms such as bacteria, yeast, or fungi to break down hazardous substances into less toxic or nontoxic substances. Bioremediation can be used to clean up contaminated soil and water. In situ bioremediation treats contaminated soil or groundwater in the location in which it is found. For ex situ bioremediation processes, contaminated soil is excavated or groundwater is pumped to the surface before they can be treated.

Bioreactor

Bioreactors use microorganisms in attached or suspended biological systems to degrade contaminants in water. In suspended biological systems, such as activated sludge, fluidized beds, or sequencing batch reactors, contaminated water is circulated in an aeration basin microbes aerobically degrade organic matter and produce carbon dioxide, water, and biomass. In attached systems, such as rotating biological contactors (RBC) and trickling filters, a microbial population is established on an inert support matrix. The cells form a sludge, which is settled out in a clarifier and is recycled to the aeration basin and disposed of.

Biosensor

A biosensor is a portable device that uses living organisms, such as microbes, or parts and products of living organisms, such as enzymes, tissues, and antibodies, to produce reactions to specific chemical contaminants.

Bioslurping

Bioslurping is the adaptation of vacuum-enhanced dewatering technologies to remediate hydrocarbon-contaminated sites. Bioslurping combines elements of both bioventing and free-product recovery to simultaneously recover free product and bioremediate soils in the vadose zone. Bioventing stimulates the aerobic bioremediation of hydrocarbon-contaminated soils and vacuum-enhanced free-product recovery extracts light nonaqueous phase liquids (LNAPL) from the capillary fringe and the water table. *See also Vadose Zone.*

Biotechnology

Biotechnology refers to the application of advanced biological techniques in the manufacture of industrial products (for example, antibiotics and insulin) or for environmental management (for example, waste recycling).

Bioventing

Bioventing is an in situ remediation technology that stimulates the natural biodegradation of aerobically degradable compounds in soil by the injection of oxygen into the subsurface. Bioventing has been used to remediate releases of petroleum products, such as gasoline, jet fuels, kerosene, and diesel fuel. *See also Bioremediation and Soil Vapor Extraction.*

Borehole

A borehole is a hole cut into the ground by means of a drilling rig.

Borehole Geophysics

Borehole geophysics are nuclear or electric technologies used to identify the physical characteristics of geologic formations that are intersected by a borehole.

Brownfields

Brownfields sites are abandoned, idled, or underused industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination.

BTEX

BTEX is the term used for benzene, toluene, ethylbenzene, and xylene-volatile aromatic compounds typically found in petroleum products, such as gasoline and diesel fuel.

Cadmium

Cadmium is a silvery-white metallic element that is used in a variety of manufacturing operations, including the manufacture of batteries, coatings, alloys, and pigments. Cadmium is a heavy metal. *See also Heavy Metal.*

Carbazole

Carbazole is formed as a result of the incomplete combustion of nitrogen-containing organic matter. When heated to decomposition, such matter emits toxic fumes of carbon monoxide, carbon dioxide, and nitrogen oxides. Carbazole is used in making photographic plates sensitive to ultraviolet light and in the manufacture of reagents, explosives, insecticides, lubricants, and rubber antioxidants.

Carbon Adsorption

Carbon adsorption is a remediation technology that removes contaminants from air or water through physical adsorption into the carbon grain. Carbon is "activated" to improve adsorption through a process that creates porous particles that have large internal surface areas. A number of commercial grades of activated carbon are available to meet the needs of specific applications.

Carbon Tetrachloride

Carbon tetrachloride is a colorless, highly volatile liquid that has a strong ethereal odor similar to that of chloroform. It mixes sparingly with water and, when heated to decomposition, emits highly toxic fumes of phosgene. Carbon tetrachloride is used primarily as a chemical intermediate in the production of the refrigerants Freon 11 and 12. It also has been used as a general solvent in industrial degreasing operations and as an industrial solvent in the manufacture of cables and semiconductors.

Chemical Dehalogenation

Chemical dehalogenation is a chemical process that removes halogens (usually chlorine) from a chemical contaminant, rendering the contaminant less hazardous. The chemical dehalogenation process can be applied to common halogenated contaminants such as PCBs and dioxins, which may be present in soil and oils. Dehalogenation can be effective in removing halogens from hazardous organic compounds, such as dioxins, PCBs, and certain chlorinated pesticides. The treatment time is short, energy requirements are moderate, and operation and maintenance costs are relatively low. This technology can be brought to the site, eliminating the need to transport hazardous wastes. *See also Polychlorinated Biphenyl and Dioxin.*

Chemical Reduction/Oxidation

Chemical treatments typically involve chemical reduction/oxidation (redox) reactions that chemically convert hazardous contaminants to nonhazardous or less toxic compounds that are more stable, less mobile, or inert. Redox reactions involve the transfer of electrons from one compound to another. Specifically, one reactant is oxidized (loses electrons) and one is reduced (gains electrons). The oxidizing agents most commonly used for treatment of hazardous contaminants are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide. In cyanide oxidation, organic cyanides are oxidized to less hazardous compounds through chemical reactions. This method can be applied in situ or ex situ to soils, sludges, sediments, and other solids and also can be applied for the in situ treatment of groundwater.

Chlorinator

A chlorinator is a device that adds chlorine, in gas or liquid form, to water or sewage to kill bacteria.

Clean Air Act (CAA)

The CAA is a federal law passed in 1970 that requires EPA to establish regulations to control the release of contaminants to the air to protect human health and environment.

Cleanup

Cleanup is the term used for actions taken to deal with a release or threat of release of a hazardous substance that could affect humans and or the environment. The term sometimes is used interchangeably with the terms remedial action, removal action, response action, or corrective action.

Clean Water Act (CWA)

CWA is a 1977 amendment to the Federal Water Pollution Control Act of 1972, which set the basic structure for regulating discharges of pollutants to U.S. waters. This law gave EPA the authority to set wastewater discharge standards on an industry-by-industry basis and to set water quality standards for all contaminants in surface waters.

Colorimetric

Colorimetric refers to chemical reaction-based indicators that are used to produce reactions to individual, or classes of compounds. The reactions, such as visible color changes or other easily noted indications, are used to detect and quantify contaminants.

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

CERCLA is a federal law passed in 1980 that created a special tax that funds a trust fund, commonly known as Superfund, to be used to investigate and clean up abandoned or uncontrolled hazardous waste sites. CERCLA required for the first time that EPA step beyond its traditional regulatory role and provide response authority to clean up hazardous waste sites. EPA has primary responsibility for managing cleanup and enforcement activities authorized under CERCLA. Under the program, EPA can pay for cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work, or take legal action to force parties responsible for contamination to clean up the site or reimburse the federal government for the cost of the cleanup. *See also Superfund.*

**Comprehensive Environmental Response,
Compensation, and Liability Information System
(CERCLIS)**

CERCLIS is a database that serves as the official inventory of Superfund hazardous waste sites. CERCLIS also contains information about all aspects of hazardous waste sites, from initial discovery to deletion from the NPL. The database also maintains information about planned and actual site activities and financial information entered by EPA regional offices. CERCLIS records the targets and accomplishments of the Superfund program and is used to report that information to the EPA Administrator, Congress, and the public. *See also National Priorities List and Superfund.*

Conceptual Site Model (CSM)

A CSM, a key element used in facilitating cleanup decisions during a site investigation, is a planning tool that organizes information that already is known about a site and identifies the additional information necessary to support decisions that will achieve the goals of the project. The project team then uses the CSM to direct field work that focuses on the information needed to remove significant unknowns from the model. The CSM serves several purposes - as a planning instrument; as a modeling and data interpretation tool; and as a means of communication among members of a project team, decision makers, stakeholders, and field personnel.

Cone Penetrometer

The cone penetrometer is a truck-mounted device that rapidly penetrates the ground to collect samples. It has been used for approximately the last 50 years for geotechnical applications, but its use for site characterization is relatively new.

Confining Layer

A "confining layer" is a geological formation characterized by low permeability that inhibits the flow of water. See also *Bedrock and Permeability*.

Contaminant

A contaminant is any physical, chemical, biological, or radiological substance or matter present in any media at concentrations that may pose a threat to human health or the environment.

Corrective Measure Study (CMS)

If the potential need for corrective measures is verified during a RCRA Facility Investigation (RFI), the owner or operator of a facility is then responsible for performing a CMS. A CMS is conducted to identify, evaluate, and recommend specific corrective measures based on a detailed engineering evaluation. Using data collected during the RFI, the CMS demonstrates that proposed measures will be effective in controlling the source of contamination, as well as problems posed by the migration of substances from the original source into the environment. The measures also must be assessed in terms of technical feasibility, ability to meet public health protection requirements and protect the environment, possible adverse environmental effects, and institutional constraints. See also *RCRA Facility Investigation*.

Corrosivity

Corrosive wastes include those that are acidic and capable of corroding metal such as tanks, containers, drums, and barrels.

Creosote

Creosote is an oily liquid obtained by the distillation of wood that is used as a wood preservative and disinfectant and often is found at wood preserving sites. See also *Aromatics and Light Nonaqueous Phase Liquid*.

Cylinder Recovery Vessel

Cylinders or containers often cannot be sampled safely through the valve mechanism because of the condition of the container. The cylinder recovery vessel (CRV) was developed to safely control the hazards posed by such containers. The system provides for sampling and recontainerization of the cylinder's contents in a contained, inert environment.

The vessel and system are designed to accommodate the high pressures and wide variety of gases and liquids present in gas cylinders.

Data Quality

The term data quality refers to all features and characteristics of data that bear on its ability to meet the stated or implied needs and expectations of the user.

Data Quality Objective (DQO)

DQOs are qualitative and quantitative statements specified to ensure that data of known and appropriate quality are obtained. The DQO process is a series of planning steps, typically conducted during site assessment and investigation, that is designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate. The DQO process involves a logical, step-by-step procedure for determining which of the complex issues affecting a site are the most relevant to planning a site investigation before any data are collected.

Dechlorination

Dechlorination, the process used primarily to treat and destroy halogenated aromatic contaminants, is the chemical reaction that removes halogens (usually chlorine) from the primary structure of the contaminating organic chemical. Dechlorination can treat contaminated liquids, soils, sludges, and sediments, as well as halogenated organics and PCBs, pesticides, and some herbicides.

Dense Nonaqueous Phase Liquid (DNAPL)

A DNAPL is one of a group of organic substances that are relatively insoluble in water and more dense than water. DNAPLs tend to sink vertically through sand and gravel aquifers to the underlying layer.

Detection Limit

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

Dibenzofurans

Dibenzofurans are a group of polynuclear aromatic compounds, some of which are toxic. *See also Polynuclear Aromatic Hydrocarbon.*

Dieldrin

Dieldrin is an insecticide that was used until 1974 to control insects on cotton, corn, and citrus crops, as well as to control locusts, mosquitoes, and termites. It also was used as a wood preservative. Most uses of dieldrin were banned in 1987.

Diffusion Samplers

Diffusion samplers use natural molecular diffusion to cause the molecules of volatile organic compounds (VOC) to pass from groundwater through a semipermeable sampler. Diffusion samplers use a membrane that is filled with water and suspended in the screened interval of a well until chemical equilibrium occurs. The sampler then is retrieved, and the contents are analyzed. Diffusion samplers may offer many advantages over conventional groundwater sampling techniques because they eliminate the need for purging and disposal and can be left in targeted areas for a period of time, thereby allowing collection of a more representative sample. Vapor-based sampler analysis, which can be performed rapidly and inexpensively on field or laboratory gas chromatographs, yields relative concentrations of VOCs. Water-based sampler analysis provides the advantage of quantifying specific concentrations of VOCs through standard laboratory methods. *See also Gas Chromatography and Volatile Organic Compounds.*

Dioxin

A dioxin is any of a family of compounds known chemically as dibenzo-p-dioxins. They are chemicals released during combustion. Concern about them arises from their potential toxicity and the risk posed by contamination in commercial products. Boilers and industrial furnaces are among the sources of dioxins.

Direct Push Sampling

Direct push sampling is a technique in which a sampling tube is hydraulically pushed or driven into the subsurface, collecting material as it advances. This technique can be used when sampling for constituents, including VOCs, SVOCs, PCBs, and PAHs.

Disposal

Disposal is the final placement or destruction of toxic, radioactive or other wastes; surplus or banned pesticides or other chemicals; polluted soils; and drums containing hazardous materials from removal actions or accidental release. Disposal may be accomplished through the use of approved secure landfills, surface impoundments, land farming, deep well injection, or ocean dumping.

Dual-Phase Extraction

Dual-phase extraction, also known as multi-phase extraction, is a technology that uses a vacuum system to remove various combinations of contaminated groundwater, separate-phase petroleum product, and vapors from the subsurface. The system lowers the water table around a well, exposing more of the formation. Contaminants in the newly exposed vadose zone then are accessible to soil vapor extraction. Once above ground, the extracted vapors or liquid-phase organics and groundwater are separated and treated. *See also Soil Vapor Extraction.*

Dynamic Underground Stripping

Dynamic underground stripping is a process that employs vapor extraction during underground steaming and electrical heating. The heat, supplied by steam and electricity, vaporizes contaminants trapped in the soil. Once vaporized, the contaminants are removed by vacuum extraction. The process is monitored and guided by underground imaging.

Dynamic Work Plan

A dynamic work plan is a work plan that allows project teams to make decisions in the field about how site activities will progress. Dynamic work plans provide the strategy for the way in which dynamic field activities will take place. As such, they document a flexible, adaptive sampling and analytical strategy. Dynamic work plans are supported by the rapid turnaround of data collected, analyzed, and interpreted in the field.

Easement

An easement is a right to use the land of another for a specific purpose, such as a right-of-way or a utility.

Electrochemical Detector Kits

Electrochemical test kits use the electrical charges of ions that make up the target analyte(s) to identify and quantify the target analyte(s) in a sample. Typically, the ions are attracted to an anode or a cathode or both, depending on their charge, resulting in the generation of an electrical current that is measured and converted into a sample concentration by the unit's display or electronics. An analyte-specific catalyst can be used to aid in the reaction. The self contained kits include all the equipment and supplies necessary to produce an analytical result.

Electrokinetic Separation

In electrokinetic separation, electrochemical and electrokinetic processes are used to desorb, and then remove, metals and polar organics. This in situ soil processing technology is primarily a separation and removal technique for extracting contaminants from soils. The principle of electrokinetic remediation relies upon application of a low-intensity direct current through the soil between ceramic electrodes that are separated into a cathode array and an anode array, mobilizing charged species and causing ions and water to move toward the electrodes. The current creates an acid front at the anode and a base front at the cathode. The generation of acidic condition in situ may help to mobilize sorbed metal contaminants to be transported to the collection system at the cathode.

Electromagnetic (EM) Geophysics

EM geophysics refers to technologies used to detect spatial (horizontal and vertical) differences in subsurface electromagnetic characteristics. The data collected provide information about subsurface environments.

Electromagnetic (EM) Induction

EM induction is a geophysical technology used to create a magnetic field beneath the earth's surface, which in turn causes a secondary magnetic field to form around nearby objects that have conductive properties, such as ferrous and nonferrous metals. The secondary magnetic field then is used to detect and measure buried debris.

Emergency Removal

An emergency removal is an action initiated in response to a release of a hazardous substance that requires on-site activity within hours of a determination that action is appropriate.

Emerging Technology

An emerging technology is an innovative technology that currently is undergoing bench-scale testing. During bench-scale testing, a small version of the technology is built and tested in a laboratory. If the technology is successful during bench-scale testing, it is demonstrated on a small scale at field sites. If the technology is successful at the field demonstrations, it often will be used full scale at contaminated waste sites. As the technology is used and evaluated at different sites, it is improved continually. *See also Established Technology and Innovative Technology.*

Enforcement Action

An enforcement action is an action undertaken by EPA under authority granted to it under various federal environmental statutes, such as CERCLA, RCRA, CAA, CWA, TSCA, and others. For example, under CERCLA, EPA may obtain voluntary settlement or compel potentially responsible parties (PRP) to implement removal or remedial actions when releases of hazardous substances have occurred. *See also Comprehensive Environmental Response, Compensation, and Liability Act; Potentially Responsible Party; and Removal Action.*

Engineered Control

An engineered control, such as barriers placed between a contaminated area and the rest of a site, is a method of managing environmental and health risks. Engineered controls can be used to limit exposure pathways.

Environmental Audit

An environmental audit usually refers to a review or investigation that determines whether an operating facility is in compliance with relevant environmental regulations. The audit may include checks for possession of required permits, operation within permit limits, proper reporting, and record keeping. The typical result is a corrective action or compliance plan for the facility.

Environmental Risk

Environmental risk is the chance that human health or the environment will suffer harm as the result of the presence of environmental hazards.

Environmental Site Assessment (ESA)

An ESA is the process that determines whether contamination is present at a site.

Established Technology

An established technology is a technology for which cost and performance information is readily available. Only after a technology has been used at many different sites and the results fully documented is that technology considered established. The most frequently used established technologies are incineration, solidification and stabilization, and pump-and-treat technologies for groundwater. *See also Emerging Technology and Innovative Technology.*

Exposure Pathway

An exposure pathway is the route of contaminants from the source of contamination to potential contact with a medium (air, soil, surface water, or groundwater) that represents a potential threat to human health or the environment. Determining whether exposure pathways exist is an essential step in conducting a baseline risk assessment. *See also Baseline Risk Assessment.*

Ex Situ

The term ex situ or "moved from its original place," means excavated or removed.

Ex Situ Bioremediation

Ex situ bioremediation uses microorganisms to degrade organic contaminants in excavated soil, sludge, and solids. The microorganisms break down contaminants by using them as a food source. The end products typically are carbon dioxide and water. Ex situ bioremediation includes slurry-phase bioremediation, in which the soils are mixed with water to form a slurry to keep solids suspended and microorganisms in contact with the soil contaminants; and solid-phase bioremediation, in which the soils are placed in a cell or building and tilled with added water and nutrients. Land farming and composting are types of solid-phase bioremediation.

Filtration

Filtration is a treatment process that removes solid matter from water by passing the water through a porous medium, such as sand or a manufactured filter.

Flame Ionization Detector (FID)

A FID is an instrument often used in conjunction with gas chromatography to measure the change of signal as analytes are ionized by a hydrogen-air flame. It also is used to detect phenols, phthalates, PAHs, VOCs, and petroleum hydrocarbons. *See also Portable Gas Chromatography.*

Fluid/Vapor Extraction

In fluid/vapor extraction, a high-vacuum system is applied to remove liquid and gas simultaneously from low-permeability or heterogeneous formations. The vacuum extraction well includes a screened section in the zone of contaminated soils and groundwater and is used to remove contaminants from above and below the water table. The system lowers the water table around the well, exposing more of the formation. Contaminants in the newly exposed vadose zone are then accessible for vapor extraction, which can remove contaminants more efficiently than pump-and-treat systems.

Fourier Transform Infrared Spectroscopy

A fourier transform infrared spectroscope is an analytical air monitoring tool that uses a laser system chemically to identify contaminants.

Fumigant

A fumigant is a pesticide that is vaporized to kill pests. They often are used in buildings and greenhouses.

Furan

Furan is a colorless, volatile liquid compound used in the synthesis of organic compounds, especially nylon.

Gas Chromatography

Gas chromatography is a technology used for investigating and assessing soil, water, and soil gas contamination at a site. It is used for the analysis of VOCs and SVOCs. The technique identifies and quantifies organic compounds on the basis of molecular weight, characteristic fragmentation patterns, and retention time. Recent advances in gas chromatography that are considered innovative are portable, weather-proof units that have self-contained power supplies.

Graphite Furnace Atomic Absorption (GFAA) Spectroscopy

Graphite furnace atomic absorption (GFAA) spectroscopy is a highly sensitive spectroscopic technique that provides excellent detection limits for measuring concentrations of metals in liquid sample media. Water samples may be analyzed directly, while soil samples first must undergo an extraction process to draw the contaminants into solution for analysis. The sample is vaporized in the graphite furnace, and light of a specific wavelength then is passed through the atomic vapor of an element of interest. The attenuation of the intensity of the light as a result of absorption is measured, and the amount of attenuation is converted into an estimate of the contaminant metal's concentration.

Ground-Penetrating Radar (GPR)

GPR is a technology that emits pulses of electromagnetic energy into the ground to measure its reflection and refraction by subsurface layers and other features, such as buried debris.

Groundwater

Groundwater is the water found beneath the earth's surface that fills pores between such materials as sand, soil, or gravel and that often supplies wells and springs. *See also Aquifer.*

Halogenated Organic Compound

A halogenated organic compound is a compound containing molecules of chlorine, bromine iodine, and fluorine. Halogenated organic compounds were used in high-voltage electrical transformers because they conducted heat well while being fire resistant and good electrical insulators. Many herbicides, pesticides, and degreasing agents are made from halogenated organic compounds.

Hazard Ranking System (HRS)

The HRS is the primary screening tool used by EPA to assess the risks posed to human health or the environment by abandoned or uncontrolled hazardous waste sites. Under the HRS, sites are assigned scores on the basis of the toxicity of hazardous substances that are present and the potential that those substances will spread through the air, surface, water, or groundwater, taking into account such factors as the proximity of the substance to nearby populations. Scores are used in determining which sites should be placed on the NPL. *See also National Priorities List.*

Hazardous Substance

As defined under CERCLA, a hazardous substance is any material that poses a threat to public health or the environment. The term also refers to hazardous wastes as defined under RCRA. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive. If a certain quantity of a hazardous substance, as established by EPA, is spilled into the water or otherwise emitted into the environment, the release must be reported. Under the legislation cited above, the term excludes petroleum, crude oil, natural gas, natural gas liquids, or synthetic gas usable for fuel.

Hazardous and Solid Waste Amendments (HSWA)

HSWA are 1984 amendments to RCRA which required phasing out land disposal of hazardous waste and added minimum technology requirements. *See also Resource Conservation and Recovery Act.*

Heavy Metal

The term heavy metal refers to a group of toxic metals including arsenic, chromium, copper, lead, mercury, silver, and zinc. Heavy metals often are present at industrial sites at which operations have included battery recycling and metal plating.

Herbicide

A herbicide is a chemical pesticide designed to control or destroy plants, weeds, or grasses.

High-Frequency Electromagnetic (EM) Sounding

High-frequency EM sounding, the technology used for nonintrusive geophysical exploration, projects high-frequency electromagnetic radiation into subsurface layers to detect the reflection and refraction of the radiation by various layers of soil. Unlike ground-penetrating radar, which uses pulses, the technology uses continuous waves of radiation. *See also Ground-Penetrating Radar.*

Hot Air Injection

With hot air injection, hot air or steam is injected below the contaminated zones to heat contaminated soil. The heating enhances the release of contaminants from the soil matrix so they can be extracted and captured for further treatment and recycling.

Hydrazine

Hydrazine is a highly toxic liquid used in rocket propellant, agricultural chemicals, drugs, spandex fibers, antioxidants, plating metals on glass and plastic, explosives, and in boiler feedwater. The chemical compound causes a severe explosion hazard when exposed to heat.

Hydrocarbon

A hydrocarbon is an organic compound containing only hydrogen and carbon, often occurring in petroleum, natural gas, and coal.

Hydrogen Sulfide (HS)

HS is a gas emitted during decomposition of organic compounds. It also is a byproduct of oil refining and burning.

Hydrogeology

Hydrogeology is the study of groundwater, including its origin, occurrence, movement, and quality.

Hydrology

Hydrology is the science that deals with the properties, movement, and effects of water found on the earth's surface, in the soil and rocks beneath the surface, and in the atmosphere.

Hydrophobic Dye

Hydrophobic dye is added to liquids to assist in the observation of the presence of items that are colorless.

Hyperaccumulator

A hyperaccumulator is a metallophyte that accumulates an exceptionally high level of a metal to a specified concentration or to a specified multiple of the concentration found in nonaccumulators. The term is used in reference to plants used in Phytoremediation. *See also Metallophytes and Phytoremediation.*

Ignitability

Ignitable wastes can create fires under certain conditions. Examples include liquids, such as solvents that readily catch fire, and friction-sensitive substances.

Immunoassay

Immunoassay is an innovative technology used to measure compound-specific reactions (generally colorimetric) to individual compounds or classes of compounds. The reactions are used to detect and quantify contaminants. The technology is available in field-portable test kits.

In Situ Thermal Treatment

In situ thermal treatment is a treatment process that involves heating contaminated soil in place to vaporize organic contaminants in the soil. The surface area to be treated is usually covered with silicone rubber mats to provide insulation and to form a vapor barrier.

Incineration

Incineration is a treatment technology that involves the burning of certain types of solid, liquid, or gaseous materials under controlled conditions to destroy hazardous waste.

Infill Development

Infill development is new construction on previously developed land in cities or developed suburbs. The term often refers to redevelopment of small residential, commercial, or industrial properties. An important aspect of many infill development projects is the enhancement of the built environment with open space and parks.

Information Repository

An information repository is a location in a public building that is convenient for local residents, such as a public school, city hall, or library, that contains information about a Superfund site, including technical reports and reference documents.

Infrared Monitor

An infrared monitor is a device used to monitor the heat signature of an object, as well as to sample air. It may be used to detect buried objects in soil.

Inorganic Compound

An inorganic compound is a compound that generally does not contain carbon atoms (although carbonate and bicarbonate compounds are notable exceptions) and tends to be more soluble in water. Examples of inorganic compounds include various acids, potassium hydroxide, and metals.

Innovative Technology

An innovative technology is a process that has been tested and used as a treatment for hazardous waste or other contaminated materials, but lacks a long history of full-scale use and information about its cost and how well it works sufficient to support prediction of its performance under a variety of operating conditions. An innovative technology is one that is undergoing pilot-scale treatability studies that usually are conducted in the field or the laboratory and require installation of the technology, and provide performance, cost, and design objectives for the technology. Innovative technologies are being used under many federal and state cleanup programs to treat hazardous wastes that have been improperly released. *See also Emerging Technology and Established Technology.*

Ion Exchange

Ion exchange, a common method of softening water, depends on the ability of certain materials to remove and exchange ions from water. These ion exchange materials, generally composed of insoluble organic polymers, are placed in a filtering device. Water softening exchange materials remove calcium and magnesium ions, replacing them with sodium ions.

Ionization

Ionization is the process which causes an atom to gain or lose electrons, which results in the atom having a negative or positive charge.

Insecticide

An insecticide is a pesticide compound specifically used to kill or control the growth of insects.

In Situ

The term in situ, "in its original place," or "on-site", means unexcavated and unmoved. In situ soil flushing and natural attenuation are examples of in situ treatment methods by which contaminated sites are treated without digging up or removing the contaminants.

In Situ Bioremediation

In situ bioremediation techniques stimulate and create a favorable environment for microorganisms to grow and use contaminants as a food and energy source. Generally, this means providing some combination of oxygen, nutrients, and moisture, and controlling the temperature and pH. Sometimes, microorganisms adapted for degradation of the specific contaminants are applied to enhance the process. Bioventing is a common form of in situ bioremediation. Bioventing uses extraction wells to circulate air with or without pumping air into the ground.

In Situ Oxidation

In situ oxidation is an innovative treatment technology that oxidizes contaminants that are dissolved in groundwater and converts them into insoluble compounds.

In Situ Soil Flushing

In situ soil flushing is an innovative treatment technology that floods contaminated soils beneath the ground surface with a solution that moves the contaminants to an area from which they can be removed. The technology requires the drilling of injection and extraction wells on site and reduces the need for excavation, handling, or transportation of hazardous substances. Contaminants considered for treatment by in situ soil flushing include heavy metals (such as lead, copper, and zinc), halogenated organic compounds, aromatics, and PCBs. *See also Aromatics, Halogenated Organic Compound, Heavy Metal, and Polychlorinated Biphenyl.*

In Situ Vitrification

In situ vitrification is a soil treatment technology that stabilizes metal and other inorganic contaminants in place at temperatures of approximately 3000°F. Soils and sludges are fused to form a stable glass and crystalline structure with very low leaching characteristics.

In Situ Well Aeration

For in situ well aeration, air is injected into a double screened well, allowing the VOCs in the contaminated groundwater to transfer from the dissolved phase to the vapor-phase by air bubbles. As the air bubbles rise to the water surface, the vapors are drawn off and treated by an SVE system.

Institutional Controls

An institutional control is a legal or institutional measure which subjects a property owner to limit activities at or access to a particular property. They are used to ensure protection of human health and the environment, and to expedite property reuse. Zoning and deed restrictions are examples of institutional controls.

Integrated Risk Information System (IRIS)

IRIS is an electronic database that contains EPA's latest descriptive and quantitative regulatory information about chemical constituents. Files on chemicals maintained in IRIS contain information related to both noncarcinogenic and carcinogenic health effects.

Joint and Several Liability

Under CERCLA, joint and several liability is a concept based on the theory that it may not be possible to apportion responsibility for the harm caused by hazardous waste equitably among potentially responsible parties (PRP). Joint liability means that more than one PRP is liable to the plaintiff. Several liability means that the plaintiff may choose to sue only one of the defendants and recover the entire amount. One PRP therefore can be held liable for the entire cost of cleanup, regardless of the share of waste that PRP contributed. Joint and several liability is used only when harm is indivisible. If defendants can apportion harm, there is no several liability. *See also Potentially Responsible Party and Strict Liability.*

Lampblack

Lampblack is a finely divided, bulky, black soot, at one time the most important black pigment used in the manufacture of printing inks. It is one of several gas plant residues found at manufactured gas plant (MGP) sites. *See also Manufactured Gas Plant.*

Land Disposal Restrictions (LDR)

LDR is a RCRA program that restricts the land disposal of RCRA hazardous wastes and requires treatment to established treatment standards or a required technology. LDRs may be an important ARAR for Superfund actions. *See also Applicable or Relevant and Appropriate Requirement and Resource Conservation and Recovery Act.*

Landfarming

Landfarming is the spreading and incorporation of wastes into the soil to initiate biological treatment.

Landfill

A sanitary landfill is a land disposal site for nonhazardous solid wastes at which the waste is spread in layers compacted to the smallest practical volume.

Laser-Induced Fluorescence/Cone Penetrometer

Laser-induced fluorescence/cone penetrometer is a field screening method that couples a fiber optic-based chemical sensor system to a cone penetrometer mounted on a truck. The technology can be used for investigating and assessing soil and water contamination.

Leachate

A leachate is a contaminated liquid that results when water collects contaminants as it trickles through wastes, agricultural pesticides, or fertilizers. Leaching may occur in farming areas and landfills and may be a means of the entry of hazardous substances into soil, surface water, or groundwater.

Lead

Lead is a highly toxic metal that was used for many years in products found in and around our homes. Lead may cause a range of health effects, from behavioral problems and learning disabilities, to seizures and death. Children 6 years old and under are most at risk, because their bodies are growing quickly. Research suggests that the primary sources of lead exposure for most children are:

- deteriorating lead-based paint,
- lead contaminated dust, and
- lead contaminated residential soil.

See also Heavy Metal

Light Nonaqueous Phase Liquid (LNAPL)

An LNAPL is one of a group of organic substances that are relatively insoluble in water and are less dense than water. LNAPLs, such as oil, tend to spread across the surface of the water table and form a layer on top of the water table.

Long-Term Monitoring

Long-term monitoring of a site typically is performed to verify that contaminants pose no risk to human health or the environment and that natural processes are reducing contaminant levels and risk as predicted.

Magnetrometry

Magnetrometry is a geophysical technology used to detect disruptions that metal objects cause in the earth's localized magnetic field.

Manufactured Gas Plant

Manufactured gas plants (MGP) were operated nationwide from the early 1880s through the mid-1900s. MGPs produced gas from coal or oil for lighting, heating, and cooking. The gas manufacturing and purification processes conducted at the plants yielded residues that included tars, sludges, lampblack, light oils, spent oxide wastes, and other hydrocarbon products. Although many of the byproducts were recycled, excess residues containing PAHs, petroleum hydrocarbons, benzene, cyanide, metals, and phenols remained at MGP sites.

Mass Spectrometry

Mass spectrometry is a method of chemical analysis in which the substance to be analyzed is heated and placed in a vacuum. The resulting vapor is exposed to a beam of electrons that causes ionization to occur, either of the molecules or their fragments. The ionized atoms are separated according to their mass and can be identified on that basis.

Mechanical Soil Aeration

Mechanical soil aeration agitates contaminated soil using tilling or other means to volatilize contaminants.

Medium

A medium is a specific environment-air, water, or soil-which is the subject of regulatory concern and activities.

Mercury

Mercury is a heavy metal that can accumulate in the environment and is found in thermometers, measuring devices, pharmaceutical and agricultural chemicals, chemical manufacturing, and electrical equipment. *See also Heavy Metal.*

Mercury Vapor Analyzer

A mercury vapor analyzer is an instrument that provides real-time measurements of concentrations of mercury in the air.

Metallophytes

Metallophytes are plants that preferentially colonize in metal-rich soils.

Methane

Methane is a colorless, nonpoisonous, flammable gas created by anaerobic decomposition of organic compounds.

Methanogenic

The term methanogenic refers to anaerobic oxidation of petroleum hydrocarbons, as well as fermentation of hydrocarbons to methane.

Methyl Tertiary Butyl Ether

Methyl tertiary butyl ether (MTBE), a synthetic chemical, is a volatile, flammable, colorless liquid. MTBE has a relatively high vapor pressure and is water soluble to a significant degree. MTBE usually is produced in a refinery by mixing a feedstock of isobutylene with methanol. The isobutylene is derived by steam-cracking during production of olefin and fluid-cracking during production of gasoline. Concern about them arises from its potential contamination of groundwater as a result of releases from underground storage tanks of gasoline that contains oxygenates. *See also Oxygenates.*

Migration Pathway

A migration pathway is a potential path or route of contaminants from the source of contamination to contact with human populations or the environment. Migration pathways include air, surface water, groundwater, and land surface. The existence and identification of all potential migration pathways must be considered during assessment and characterization of a waste site.

Mixed Waste

Mixed waste is low-level radioactive waste contaminated with hazardous waste that is regulated under RCRA. Mixed waste can be disposed only in compliance with the requirements under RCRA that govern disposal of hazardous waste and with the RCRA land disposal restrictions, which require that waste be treated before it is disposed of in appropriate landfills.

Mobile Laboratory

A mobile laboratory refers to a collection of analytical instruments contained in a vehicle that can be deployed to a project site. A mobile laboratory offers many of the advantages of a fixed laboratory, such as protection from the elements, a power supply, and climate control, while still providing the advantages of analyzing samples on site while the project is in progress. A mobile laboratory may even allow the use of laboratory-grade instruments which otherwise could not be taken into the field. Configurations can vary in sophistication from a single instrument mounted in a sampling van, to large truck trailers and recreational vehicles equipped with multiple instruments and laboratory-grade support equipment.

Monitored Natural Attenuation

The term monitored natural attenuation refers to the remedial approach that allows natural processes to reduce concentrations of contaminants to acceptable levels. Monitored natural attenuation involves physical, chemical, and biological processes that act to reduce the mass, toxicity, and mobility of subsurface contamination. Physical, chemical, and biological processes involved in monitored natural attenuation include biodegradation, chemical stabilization, dispersion, sorption, and volatilization.

Monitoring Well

A monitoring well is a well drilled at a specific location on or off a hazardous waste site at which groundwater can be sampled at selected depths and studied to determine the direction of groundwater flow and the types and quantities of contaminants present in the groundwater.

Mothballed Sites

The term mothballed sites refers to large, idle areas that formerly were used for manufacturing and other industrial uses and are not available for sale or redevelopment.

National Contingency Plan (NCP)

The NCP, formally the National Oil and Hazardous Substances Contingency Plan, is the major regulatory framework that guides the Superfund response effort. The NCP is a comprehensive body of regulations that outlines a step-by-step process for implementing Superfund responses and defines the roles and responsibilities of EPA, other federal agencies, states, private parties, and the communities in response to situations in which hazardous substances are released into the environment. *See also Superfund.*

National Pollutant Discharge Elimination System (NPDES)

NPDES is the primary permitting program under the Clean Water Act, which regulates all discharges to surface water. It prohibits discharge of pollutants into waters of the United States unless EPA, a state, or a tribal government issues a special permit to do so.

National Priorities List (NPL)

The NPL is EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response under Superfund. Inclusion of a site on the list is based primarily on the score the site receives under the HRS. Money from Superfund can be used for cleanup only at sites that are on the NPL. EPA is required to update the NPL at least once a year. *See also Hazard Ranking System and Superfund.*

National Response Center (NRC)

The NRC, staffed by the U.S. Coast Guard, is a communications center that receives reports of discharges or releases of hazardous substances into the environment. The U.S. Coast Guard in turn, relays information about such releases to the appropriate federal agency.

Neutralization

Neutralization is a chemical reaction between an acid and a base. The reaction involves acidic or caustic wastes that are neutralized using caustic or acid additives.

Nitric Oxide

Nitric oxide is a gas formed by combustion under high temperature and high pressure in an internal combustion engine.

Nonaqueous Phase Liquid (NAPL)

NAPLs are organic substances that are relatively insoluble in water and are less dense than water. *See also Dense Nonaqueous Phase Liquid and Light Nonaqueous Phase Liquid.*

Non-Point Source

The term non-point source is used to identify sources of pollution that are diffuse and do not have a point of origin or that are not introduced into a receiving stream from a specific outlet. Common non-point sources are rain water, runoff from agricultural lands, industrial sites, parking lots, and timber operations, as well as escaping gases from pipes and fittings.

Operation and Maintenance (O&M)

O&M refers to the activities conducted at a site, following remedial actions, to ensure that the cleanup methods are working properly. O&M activities are conducted to maintain the effectiveness of the remedy and to ensure that no new threat to human health or the environment arises. Under the Superfund program, the state or PRP assumes responsibility for O&M, which may include such activities as groundwater and air monitoring, inspection and maintenance of the treatment equipment remaining on site, and maintenance of any security measures or institutional controls.

Organic Chemical or Compound

An organic chemical or compound is a substance produced by animals or plants that contains mainly carbon, hydrogen, and oxygen.

Oxygenate

Oxygenates are hydrocarbons added to fuels to increase the oxygen content of those fuels to improve combustion, thereby reducing emissions, such as carbon monoxide and other pollutants. Examples of oxygenates include methyl tertiary butyl ether (MTBE), ethyl tertiary butyl ether (ETBE), tertiary amyl methyl ether (TAME), ethanol, and other ethers and alcohols. *See also Methyl Tertiary Butyl Ether.*

Ozone

Ozone is a form of oxygen found naturally which provides a protective layer in the stratosphere shielding the earth from the harmful health effects on human health and the environment from ultraviolet radiation. Ozone also is a chemical oxidant and a major component of smog in the troposphere, the earth's atmospheric layer below the stratosphere extending 7 to 10 miles from the earth's surface.

Pentachlorophenol (PCP)

PCP, a chemical compound containing carbon, chlorine, oxygen, and hydrogen, is a contaminant used in feed stock material and chemical manufacturing.

Performance-Based Measurement System (PBMS)

EPA defines PBMS as a set of processes through which the data needs or limitations of a program or project are specified and serve as criteria for selected appropriate methods to meet those needs in a cost effective manner. EPA uses the term to convey what must be accomplished, but not prescriptively how to do it. The PBMS initiative places regulatory emphasis on obtaining analytical results that provide adequate information to support the regulatory decision, but leaves the choice of analytical procedures up to the user. The PBMS approach gives regulators and members of the regulated community increased flexibility in selecting technologies, while still meeting mandated monitoring requirements. The use of PBMS is intended to reduce barriers to the use of new monitoring technologies.

Permeability

Permeability is a characteristic that represents a qualitative description of the relative ease with which rock, soil, or sediment will transmit a fluid (liquid or gas).

Permeable Reactive Barriers

Permeable reactive barriers, also known as passive treatment walls, are installed across the flow path of a contaminated plume. As groundwater flows through the PRB, contaminants are either degraded or retained in a concentrated form by the reactive material. Examples of reactive media include zero-valent metals, chelators, sorbents, and microbes.

Pesticide

A pesticide is a substance or mixture of substances intended to prevent or mitigate infestation by, or destroy or repel, any pest. Pesticides can accumulate in the food chain and or contaminate the environment if misused.

Phase I Environmental Assessment

A Phase I environmental assessment is an initial environmental investigation that is limited to a historical records search to determine ownership of a site and to identify the kinds of chemical processes that were carried out at the site. A Phase I assessment includes a site visit, but does not include any sampling. If such an assessment identifies no significant concerns, Phase II and III audits are not necessary. Phase I assessments also are commonly referred to as site assessments.

Phase II Environmental Assessment

A Phase II environmental assessment is an investigation that includes tests performed at the site to confirm the location and identity of environmental hazards. The assessment includes preparation of a report that includes recommendations for cleanup alternatives. Phase II assessments also are commonly referred to as site investigations.

Phase III Environmental Site Cleanup

A Phase III environmental site cleanup is the third step in the assessment that includes the removal of contaminated materials from a site and their legal disposal.

Phenols

A phenol is one of a group of organic compounds that are byproducts of petroleum refining, tanning, and textile, dye, and resin manufacturing.

Photoionization Detector (PID)

A PID is a nondestructive detector, often used in conjunction with gas chromatography, that measures the change of signal as analytes are ionized by an ultraviolet lamp. The PID also is used to detect VOCs and petroleum hydrocarbons. *See also Portable Gas Chromatography.*

Physical Separation

Physical separation processes use different size sieves and screens to concentrate contaminants into smaller volumes. Most organic and inorganic contaminants tend to bind, either chemically or physically, to the fine fraction of the soil. Fine clay and silt particles are separated from the coarse sand and gravel soil particles to concentrate the contaminants into a smaller volume of soil that could then be further treated or disposed.

Phytoremediation

Phytoremediation is an innovative treatment technology that uses plants and trees to clean up contaminated soil and water. Plants can break down, or degrade, organic pollutants or stabilize metal contaminants by acting as filters or traps. Phytoremediation can be used to clean up metals, pesticides, solvents, explosives, crude oil, polyaromatic carbons, and landfill leachates. Its use generally is limited to sites at which concentrations of contaminants are relatively low and contamination is found in shallow soils, streams, and groundwater.

Phytotechnology

The term phytotechnology refers to technologies that use living plants. *See also Phytoremediation.*

Phytotoxic

The term phytotoxic is used to describe a substance that is harmful to plants.

Plasma High-Temperature Metals Recovery

Plasma high-temperature metals recovery is a thermal treatment process that purges contaminants from solids and soils such as metal fumes and organic vapors. The vapors can be burned as fuel, and the metal fumes can be recovered and recycled. This innovative treatment technology is used to treat contaminated soil and groundwater.

Plume

A plume is a visible or measurable emission or discharge of a contaminant from a given point of origin into any medium. The term also is used to refer to measurable and potentially harmful radiation leaking from a damaged reactor.

Point Source

A point source is a stationary location or fixed facility from which pollutants are discharged or emitted or any single, identifiable discharge point of pollution, such as a pipe, ditch, or smokestack.

Polychlorinated Biphenyl (PCB)

PCBs are a group of toxic, persistent chemicals, produced by chlorination of biphenyl, that once were used in high voltage electrical transformers because they conducted heat well while being fire resistant and good electrical insulators. These contaminants typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes.

Polycyclic Aromatic Hydrocarbon (PAH)

A PAH is a chemical compound that contains more than one fused benzene ring. They are commonly found in petroleum fuels, coal products, and tar.

Potassium Permanganate

Potassium permanganate is a crystalline compound that is soluble in water, acetone, and methanol, but is decomposed by ethanol. It is used widely as a powerful oxidizing agent, as a disinfectant in a variety of applications, and as an analytical oxidant reagent in redox titrations.

Potentially Responsible Party (PRP)

A PRP is an individual or company (such as owners, operators, transporters, or generators of hazardous waste) that is potentially responsible for, or contributing to, the contamination problems at a Superfund site. Whenever possible, EPA requires PRPs, through administrative and legal actions, to clean up hazardous waste sites they have contaminated. *See also Comprehensive Environmental Response, Compensation, and Liability Act and Superfund.*

Preliminary Assessment and Site Inspection (PA/SI)

A PA/SI is the process of collecting and reviewing available information about a known or suspected hazardous waste site or release. The PA/SI usually includes a visit to the site.

Presumptive Remedies

Presumptive remedies are preferred technologies for common categories of CERCLA sites that have been identified through historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation.

Pump and Treat

Pump and treat is a general term used to describe remediation methods that involve the pumping of groundwater to the surface for treatment. It is one of the most common methods of treating polluted aquifers and groundwater.

Quality Assurance (QA)

QA is a system of management activities that ensure that a process, item, or service is of the type and quality needed by the user. QA deals with setting policy and implementing an administrative system of management controls that cover planning, implementation, and review of data collection activities. QA is an important element of a quality system that ensures that all research design and performance, environmental monitoring and sampling, and other technical and reporting activities conducted by EPA are of the highest possible quality.

Quality Control (QC)

QC refers to scientific precautions, such as calibrations and duplications, that are necessary if data of known and adequate quality are to be acquired. QC is technical in nature and is implemented at the project level. Like QA, QC is an important element of a quality system that ensures that all research design and performance, environmental monitoring and sampling, and other technical and reporting activities conducted by EPA are of the highest possible quality.

Radioactive Waste

Radioactive waste is any waste that emits energy as rays, waves, or streams of energetic particles. Sources of such wastes include nuclear reactors, research institutions, and hospitals.

Radionuclide

A radionuclide is a radioactive element characterized according to its atomic mass and atomic number, which can be artificial or naturally occurring. Radionuclides have a long life as soil or water pollutants. Radionuclides cannot be destroyed or degraded; therefore, applicable technologies involve separation, concentration and volume reduction, immobilization, or vitrification. *See also Solidification and Stabilization.*

Radon

Radon is a colorless, naturally occurring, radioactive, inert gaseous element formed by radioactive decay of radium atoms. *See also Radioactive Waste and Radionuclide.*

RCRA Facility Assessment (RFA)

A RFA is performed at a facility to determine the existence of any continuous or non-continuous releases of wastes. During the RFA, EPA or state regulators gather information on solid waste management units and other areas of concern at RCRA facilities, evaluate this information to determine whether there are releases that warrant further investigation and action, and determine the need to proceed to a RCRA Facility Investigation. *See also Resource Conservation and Recovery Act.*

RCRA Facility Investigation (RFI)

The purpose of a RFI is to gather sufficient data at a facility to fully characterize the nature, extent, and rate of migration of contaminant releases identified in the RCRA Facility Assessment. The data generated during the RFI is used to determine the potential need for corrective measures and to aid in the selection and implementation of these measures. *See also Corrective Measure Study and Resource Conservation and Recovery Act.*

Reactivity

Reactive wastes are unstable under normal conditions. They can create explosions and or toxic fumes, gases, and vapors when mixed with water.

Record of Decision (ROD)

A ROD is a legal, technical, and public document that explains which cleanup alternative will be used at a Superfund NPL site. The ROD is based on information and technical analysis generated during the remedial investigation and feasibility study (RI/FS) and consideration of public comments and community concerns. *See also Preliminary Assessment and Site Investigation and Remedial Investigation and Feasibility Study.*

Release

A release is any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, leaching, dumping, or disposing into the environment of a hazardous or toxic chemical or extremely hazardous substance, as defined under RCRA. *See also Resource Conservation and Recovery Act.*

Remedial Design and Remedial Action (RD/RA)

The RD/RA is the step in the Superfund cleanup process that follows the RI/FS and selection of a remedy. An RD is the preparation of engineering plans and specifications to properly and effectively implement the remedy. The RA is the actual construction or implementation of the remedy. *See also Remedial Investigation and Feasibility Study.*

Remedial Investigation and Feasibility Study (RI/FS)

The RI/FS is the step in the Superfund cleanup process that is conducted to gather sufficient information to support the selection of a site remedy that will reduce or eliminate the risks associated with contamination at the site. The RI involves site characterization -- collection of data and information necessary to characterize the nature and extent of contamination at the site. The RI also determines whether the contamination presents a significant risk to human health or the environment. The FS focuses on the development of specific response alternatives for addressing contamination at a site.

Removal Action

A removal action usually is a short-term effort designed to stabilize or clean up a hazardous waste site that poses an immediate threat to human health or the environment. Removal actions include removing tanks or drums of hazardous substances that were found on the surface and installing drainage controls or security measures, such as a fence at the site. Removal actions also may be conducted to respond to accidental releases of hazardous substances. CERCLA places time and money constraints on the duration of removal actions. *See also Comprehensive Environmental Response, Compensation, and Liability Act.*

Reportable Quantity (RQ)

The RQ is the quantity of hazardous substances that, when released into the environment, can cause substantial endangerment to public health or the environment. Under CERCLA, the federal government must be notified when quantities equaling or exceeding RQs specified in regulations are released.

Representative Sampling

The term representative sampling refers to a portion of material or water that is as nearly identical in content and consistency as possible to that in a larger body of material or water being sampled. To prevent segregation and to provide a level of accuracy, the sample is representative of the volume and nature of the material being sampled.

Resin

Resins are solids or semi-solids of plant origin used principally in lacquers, varnishes, inks, adhesives, synthetic plastics, and pharmaceuticals. **Resource Conservation and Recovery Act (RCRA)** RCRA is a federal law enacted in 1976 that established a regulatory system to track hazardous substances from their generation to their disposal. The law requires the use of safe and secure procedures in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent the creation of new, uncontrolled hazardous waste sites.

Response Action

A response action is a short-term removal action or a long-term remedial response, authorized under CERCLA that is taken at a site to address releases of hazardous substances.

Reuse Assessment

A reuse assessment involves the collection and evaluation of information to develop assumptions about reasonably anticipated future land use(s) at Superfund sites. It provides a tool for implementing the Superfund land use directive and can involve a review of available records, visual inspections of the site, and discussions with local government officials, property owners, and community members about potential future land uses.

Risk-Based Corrective Action (RBCA)

As defined by EPA, RBCA is a streamlined approach through which exposure and risk assessment practices are integrated with traditional components of the corrective action process to ensure that appropriate and cost-effective remedies are selected and that limited resources are allocated properly. RBCA refers specifically to the standard *Guide for Risk-Based Corrective Action Applied At Petroleum Release Sites*, published by ASTM. The RBCA process can be tailored to applicable state and local laws and regulatory practices. *See also American Society for Testing and Materials.*

Risk-Based Decision-Making (RBDM)

The term RBDM refers to a process through which decisions are made about contaminated sites according to the risk each site poses to human health and the environment. RBDM is a mechanism for identifying necessary and appropriate action at any phase of the corrective action process. Depending on known or anticipated risks to human health and the environment, appropriate action can include site closure, monitoring and data collection, active or passive remediation, containment, or imposition of institutional controls.

Risk Communication

Risk communication, the exchange of information about health or environmental risks among risk assessors, risk managers, the local community, news media and interest groups, is the process of informing members of the local community about environmental risks associated with a site and the steps that are being taken to manage those risks.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) of 1974 was established to protect the quality of drinking water in the United States. The act focuses on all waters actually or potentially designed for use as drinking water, whether from aboveground or underground sources. The Act authorized EPA to establish safe standards of purity and requires all owners or operators of public water systems to comply with primary (health-related) standards. State governments that assume that authority from EPA also encourage attainment of secondary (nuisance-related) standards.

Sampling and Analysis Plan

A sampling and analysis plan (SAP) documents the procedural and analytical requirements for a one-time or time-limited project that involves the collection of samples of water, soil, sediment, or other media to characterize areas of potential environmental contamination. A SAP contains all the elements of a quality assurance project plan (QAPP) and a field sampling plan (FSP) that must be provided to meet the requirements for any project funded by the EPA under which environmental measurements are to be taken.

Sanborn Map

A Sanborn map is a record kept for insurance purposes that shows, for a specific property, the locations of such items as USTs, buildings, and areas where chemicals have been used for certain industrial processes. A Phase I environmental audit includes a review of Sanborn maps. *See also Phase I Environmental Audit.*

Saturated Zone

The saturated zone is the area beneath the surface of the land in which all openings are filled with water.

Seismic Reflection and Refraction

Seismic reflection and refraction is a technology used to examine the geophysical features of soil and bedrock, such as debris, buried channels, and other features.

Semi-Volatile Organic Compound (SVOC)

SVOCs, composed primarily of carbon and hydrogen atoms, have boiling points greater than 200°C. Common SVOCs include PCBs and phenol. *See also Phenol and Polychlorinated Biphenyl.*

Significant Threat

The term refers to the level of contamination that a state would consider significant enough to warrant an action. The thresholds vary from state to state.

Site Specific Risk Assessment

The site specific risk assessment approach (SSRA) and risk management are approaches which may be used instead of the background or generic approaches. Rather than using existing soil or groundwater quality criteria, the SSRA approach establishes criteria for a specific site or for a level of exposure protection based on risk.

Risk assessment is a scientific technique which estimates the risk posed to humans, plants, wildlife and the natural environment from exposure to a contaminant. Because site specific characteristics are incorporated in a risk assessment, there will be numerical differences between the generic criteria for a site and those developed through SSRA.

Risk management decisions may be made using the results of an SSRA. These decisions may lead to use of techniques to manage contaminants, control their movement or reduce their concentrations over time, either in conjunction with site reuse or independent of it.

When risk management decisions involve use of engineered measures to reduce the levels of risk at a site, the type of monitoring and maintenance required for the techniques used and the responsibility for ensuring that they continue to operate as designed must be outlined in a risk management plan.

Six-Phase Soil Heating

Six-phase soil heating is an in situ thermal technology for the remediation of contamination of soil and groundwater. The process splits conventional electricity into six electrical phases for the electrical resistive heating of soil and groundwater. Each electrical phase is delivered to one of six electrodes placed in a hexagonal array. The voltage gradient between phases causes an electrical current to flow through the soil and groundwater. Resistivity causes the temperature to rise. As the soil and groundwater are heated uniformly to the boiling point of water, the water becomes steam, stripping volatile and semivolatile contaminants from the pore spaces. In addition, removal of the soil moisture increases the air permeability of the soils, which can further increase the rate at which contaminants are removed.

Site Characterization and Analysis Penetrometer System

The Site Characterization and Analysis Penetrometer System (SCAPS) was developed by the Division of the Naval Command, Control, and Ocean Surveillance Center (NCCOSC), in collaboration with the U.S. Army and the U. S. Air Force. SCAPS, a cone penetrometer testing system, coupled with laser-induced fluorescence (LIF), measures fluorescence with optical fibers. The measurement is made through a sapphire window on a probe that is pushed into the ground with a truck-mounted cone penetrometer testing platform. *See also Cone Penetrometer and Laser-Induced Fluorescence/Cone Penetrometer.*

Sludge

Sludge is a semisolid residue from air or water treatment processes. Residues from treatment of metal wastes and the mixture of waste and soil at the bottom of a waste lagoon are examples of sludge, which can be a hazardous waste.

Slurry-Phase Bioremediation

Slurry-phase bioremediation, a treatment technology that can be used alone or in conjunction with other biological, chemical, and physical treatments, is a process through which organic contaminants are converted to innocuous compounds. Slurry-phase bioremediation can be effective in treating various SVOCs and nonvolatile organic compounds, as well as fuels, creosote, PCPs, and PCBs.

Soil Boring

Soil boring is a process by which a soil sample is extracted from the ground for chemical, biological, and analytical testing to determine the level of contamination present.

Soil Flushing

In soil flushing, large volumes of water, at times supplemented with treatment compounds, are applied to the soil or injected into the groundwater to raise the water table into the zone of contaminated soil. Contaminants are leached into the groundwater, and the extraction fluids are recovered from the underlying aquifer. When possible, the fluids are recycled.

Soil Gas

Soil gas consists of gaseous elements and compounds that occur in the small spaces between particles of the earth and soil. Such gases can move through or leave the soil or rock, depending on changes in pressure.

Soil Vapor Extraction (SVE)

SVE is a process that physically separates contaminants from soil in a vapor form by exerting a vacuum through the soil formation. SVE removes VOCs and some SVOCs from soil beneath the ground surface.

Soil Washing

Soil washing is an innovative treatment technology that uses liquids (usually water, sometimes combined with chemical additives) and a mechanical process to scrub soils, removes hazardous contaminants, and concentrates the contaminants into a smaller volume. The technology is used to treat a wide range of contaminants, such as metals, gasoline, fuel oils, and pesticides. Soil washing is a relatively low-cost alternative for separating waste and minimizing volume as necessary to facilitate subsequent treatment. It is often used in combination with other treatment technologies. The technology can be brought to the site, thereby eliminating the need to transport hazardous wastes.

Solidification and Stabilization

Solidification and stabilization are the processes of removing wastewater from a waste or changing it chemically to make the waste less permeable and susceptible to transport by water. Solidification and stabilization technologies can immobilize many heavy metals, certain radionuclides, and selected organic compounds, while decreasing the surface area and permeability of many types of sludge, contaminated soils, and solid wastes.

Solubility

Solubility is a measure of the amount of solute that will dissolve in a solution. It is the ability or tendency of one substance to dissolve into another at a given temperature and pressure and is generally expressed in terms of the amount of solute that will dissolve in a given amount of solvent to produce a saturated solution.

Solvent

A solvent is a substance, usually liquid, that is capable of dissolving or dispersing one or more other substances.

Solvent Extraction

Solvent extraction is an innovative treatment technology that uses a solvent to separate or remove hazardous organic contaminants from oily-type wastes, soils, sludges, and sediments. The technology does not destroy contaminants, but concentrates them so they can be recycled or destroyed more easily by another technology. Solvent extraction has been shown to be effective in treating sediments, sludges, and soils that contain primarily organic contaminants, such as PCBs, VOCs, halogenated organic compounds, and petroleum wastes. Such contaminants typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes. Solvent extraction is a transportable technology that can be brought to the site. *See also Halogenated Organic Compound, Polychlorinated Biphenyl, and Volatile Organic Compound.*

Standard Operating Procedure

A standard operating procedure (SOP) is a step-by-step procedure that promotes uniformity in operations to help clarify and augment such operations. SOPs document the way activities are to be performed to facilitate consistent conformance to technical and quality system requirements and to support data quality. The use of SOPs is an integral part of a successful quality system because SOPs provide individuals with the information needed to perform a job properly and facilitate consistency in the quality and integrity of a product or end result. SOPs also provide guidance in areas in which the exercise of professional judgment is necessary and specify procedures that are unique to each task.

Steam Injection

Steam injection is a remediation technology that uses the addition of steam to the subsurface to heat the soil and groundwater and drive off contaminants. The technology was developed by the petroleum industry to enhance recovery of oils from reservoirs, and has been adapted by the remediation industry for use in the recovery of organic contaminants from the subsurface.

Stratigraphy

Stratigraphy is the study of the formation, composition, and sequence of sediments, whether consolidated or not.

Strict Liability

Strict liability is a concept under CERCLA that empowers the federal government to hold PRPs liable without proving that the PRPs were at fault and without regard to a PRP's motive. PRPs can be found liable even if the problems caused by the release of a hazardous substance were unforeseeable, the PRPs acted in good faith, and state-of-the-art hazardous waste management practices were used at the time the materials were disposed of. *See also Potentially Responsible Party.*

Subsurface

Underground; beneath the surface.

Surfactant Flushing

Surfactant flushing is a technology used to treat contaminated groundwater. Surfactant flushing of NAPLs increases the solubility and mobility of the contaminants in water so that the NAPLs can be biodegraded more easily in an aquifer or recovered for treatment aboveground. *See also Nonaqueous Phase Liquid.*

Surface Water

Surface water is all water naturally open to the atmosphere, such as rivers, lakes, reservoirs, streams, and seas.

Superfund

Superfund is the trust fund that provides for the cleanup of hazardous substances released into the environment, regardless of fault. The Superfund was established under CERCLA and subsequent amendments to CERCLA. The term Superfund also is used to refer to cleanup programs designed and conducted under CERCLA and its subsequent amendments. *See also Comprehensive Environmental Response, Compensation, and Liability Act.*

Superfund Amendment and Reauthorization Act (SARA)

SARA is the 1986 act amending CERCLA that increased the size of the Superfund trust fund and established a preference for the development and use of permanent remedies, and provided new enforcement and settlement tools. *See also Comprehensive Environmental Response, Compensation, and Liability Act.*

Superfund Innovative Technology Evaluation (SITE) Program

The SITE program is an effort established by EPA in 1986 to advance the development, evaluation, and commercialization of innovative treatment technologies for assessing and cleaning up hazardous waste sites. The program provides an opportunity for technology developers to demonstrate their technologies' ability to successfully process and remediate hazardous waste. The SITE program has four components—the Emerging Technology Program, the Demonstration Program, the Measurement and Monitoring Program, and the Technology Transfer Program.

Systematic Planning

Systematic planning is a planning process that is based on the scientific method. It is a common-sense approach designed to ensure that the level of detail in planning is commensurate with the importance and intended use of the data, as well as the available resources. Systematic planning is important to the successful execution of all activities at hazardous waste sites, but it is particularly important to dynamic field activities because those activities rely on rapid decision-making. The data quality objective (DQO) process is one formalized process of systematic planning. All dynamic field activities must be designed through the use of systematic planning, whether using DQO steps or some other system. *See also Data Quality Objective.*

Test Methods for Evaluating Waste, Physical/Chemical Methods (SW-846)

SW-846 refers to an EPA guidance and reference document, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, which is intended to assist analytical chemists and other users in the RCRA and Superfund programs by suggesting procedures that analysts have found to be successful when applied to typical samples. The SW-846 methods are analytical and sampling methods that have been evaluated and approved for use in complying with RCRA regulations. The methods are not intended to be prescriptive, nor are all technologies or methods that may be used are identified.

Tetrachloroethene

Tetrachloroethene is a nonflammable manufactured chemical widely used for dry cleaning fabrics and in metal-degreasing operations. It also is used as a starting material (building block) for the production of other manufactured chemicals. Other names for tetrachloroethene include PERC, tetrachloroethylene, perchloroethylene, and PCE.

Thermal Desorption

Thermal desorption is an innovative treatment technology that heats soils contaminated with hazardous wastes to temperatures from 200 to 1,000°F so that contaminants that have low boiling points will vaporize and separate from the soil. The vaporized contaminants then are collected for further treatment or destruction, typically by an air emissions treatment system. The technology is most effective at treating VOCs, SVOCs and other organic contaminants, such as PCBs, PAHs, and pesticides. It is effective in separating organics from refining wastes, coal tar wastes, waste from wood treatment, and paint wastes. It also can separate solvents, pesticides, PCBs, dioxins, and fuel oils from contaminated soil. *See also Polyaromatic Hydrocarbon, Polychlorinated Biphenyl, Semivolatile Organic Compound, and Volatile Organic Compound.*

Toluene

Toluene is a colorless liquid chemical with a sweet, strong odor. It is used as a solvent in aviation gasoline and in making other chemicals, perfumes, medicines, dyes, explosives, and detergents.

Total Petroleum Hydrocarbon (TPH)

TPH refers to a measure of concentration or mass of petroleum hydrocarbon constituents present in a given amount of air, soil, or water.

Toxicity

Toxicity is a quantification of the degree of danger posed by a substance to animal or plant life.

Toxicity Characteristic Leaching Procedure (TCLP)

The TCLP is a testing procedure used to identify the toxicity of wastes and is the most commonly used test for degree of mobilization offered by a solidification and stabilization process. Under this procedure, a waste is subjected to a process designed to model the leaching effects that would occur if the waste was disposed of in a RCRA Subtitle D municipal landfill. *See also Solidification and Stabilization.*

Toxic Substance

A toxic substance is a chemical or mixture that may present an unreasonable risk of injury to health or the environment.

Toxic Substances Control Act (TSCA)

TSCA was enacted in 1976 to test, regulate, and screen all chemicals produced or imported into the U.S. TSCA requires that any chemical that reaches the consumer marketplace be tested for possible toxic effects prior to commercial manufacture. Any existing chemical that poses health and environmental hazards is tracked and reported under TSCA.

Treatment, Storage, and Disposal Facility (TSD)

TSDs are sites at which hazardous substances are treated, stored, or disposed. TSD facilities are regulated by EPA and states under RCRA. *See also Resource Conservation and Recovery Act.*

Trichloroethene (TCE)

TCE is a stable, low-boiling colorless liquid that is used as a solvent, metal degreasing agent, and in other industrial applications. TCE also is known as trichloroethylene.

Ultraviolet (UV) Fluorescence

An UV fluorescence system and analytical technique is based on imaging of UV-excited fluorescence from a contaminant. A camera is gated and synchronized with a pulsed UV light source to refuse interfering ambient light. Under computer control, a liquid crystal tuned filter (LCTF) selects the spectral band of fluorescence. As an alternative, an interference filter can be used to provide a higher light throughput at a particular spectral region. The multispectral features allow optimization of the detection of a particular contaminant on a selected material surface. The system is transportable and the imaging head is small enough to be mounted on a tripod or controlled by robots.

Uncertainty

The term uncertainty refers to the inherent unknown quantities present in all scientific and technical decisions. Uncertainties can arise from incomplete knowledge of the nature and extent of contamination, an inability to predict a technology's performance under site-specific conditions, or new or changing regulatory requirements.

Underground Injection Control

Underground injection control (UIC) is the prevention of contamination by keeping injected fluids within the well and the intended injection zone or, in the case of the injection of fluids directly or indirectly into an underground source of drinking water (USDW), ensuring that injected fluids do not cause a public water system to violate drinking-water standards or otherwise have an adverse effect on public health. The minimum requirements affect the siting of an injection well and the construction, operation, maintenance, monitoring, testing, and closure of the well.

Underground Storage Tank (UST)

A UST is a tank and any underground piping connected to the tank that is used to contain gasoline or other petroleum products or chemical solutions and that is placed in such a manner that at least 10 percent of its combined volume is underground.

Unexploded Ordnance

The term exploded ordnance refers to any munition, weapon delivery system, or ordnance item that contains explosives, propellants, and chemical agents. Unexploded ordnance (UXO) consists of the same items after they: (1) have been armed or otherwise prepared for action; (2) have been launched, placed, fired, or released in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (3) remain unexploded either by design or by malfunction, or for any other reason.

Unsaturated Zone

The unsaturated zone is the area between the land surface and the uppermost aquifer (or saturated zone). The soils in an unsaturated zone may contain air and water.

Vadose Zone

The vadose zone is the area between the surface of the land and the surface of the water table in which the moisture content is less than the saturation point and the pressure is less than atmospheric. The openings (pore spaces) also typically contain air or other gases.

Vapor

Vapor is the gaseous phase of any substance that is liquid or solid at atmospheric temperatures and pressures. Steam is an example of a vapor.

Vitrification

Vitrification is a process that uses electrical power to heat and melt soil contaminated with organic or inorganic contaminants. As the molten material cools, it forms a hard glass and crystalline product that incorporates the contaminants. Vitrification can be performed in situ or ex situ and typically involves temperatures above 2,000EC.

Volatile Organic Compound (VOC)

A VOC is one of a group of carbon-containing compounds that evaporate readily at room temperature. Examples of VOCs include trichloroethane; trichloroethylene; and BTEX. These contaminants typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes.

Volatilization

Volatilization is the process of transfer of a chemical from the aqueous or liquid phase to the gas phase. Solubility, molecular weight, and vapor pressure of the liquid and the nature of the gas-liquid affect the rate of volatilization.

Voltammetric Stripping

Voltammetric stripping is a field-portable technology that uses electrochemistry to detect and quantify metals in environmental samples. Specific metals can be targeted for detection and quantification by the technology, which generally is applied to water samples.

Voluntary Cleanup Program (VCP)

A VCP is a formal means established by many states to facilitate assessment, cleanup, and redevelopment of brownfields sites. VCPs typically address the identification and cleanup of potentially contaminated sites that are not on the Superfund NPL. Under VCPs, owners or developers of a site are encouraged to approach the state voluntarily to work out a process by which the site can be readied for development. Many state VCPs provide technical assistance, liability assurances, and funding support for such efforts. *See also National Priorities List.*

Wastewater

Wastewater is spent or used water from an individual home, a community, a farm, or an industry that contains dissolved or suspended matter.

Water Table

A water table is the boundary between the saturated and unsaturated zones beneath the surface of the earth, the level of groundwater, and generally is the level to which water will rise in a well. *See also Aquifer and Groundwater.*

X-Ray Fluorescence Analyzer

An x-ray fluorescence analyzer is a self-contained, field-portable instrument, consisting of an energy dispersive x-ray source, a detector, and a data processing system that detects and quantifies individual metals or groups of metals.

Zoning

Zoning is the exercise of the civil authority of a municipality to regulate and control the character and use of property.