



# Inglês Técnico

**Engenharia Química**

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# Introdução

Neste material, exploraremos os termos e expressões essenciais necessários para uma comunicação eficaz no campo da engenharia química.

Você desenvolverá habilidades para articular conceitos e processos químicos de forma clara e precisa, enquanto adquire a capacidade de compreender e responder de maneira eficaz aos desafios e demandas desta área.

Estamos entusiasmados para iniciar esta jornada de aprendizado com você, contribuindo para o seu sucesso profissional como Engenheiro Químico!

Vamos começar!

# Orientação

**Siga estas orientações para otimizar o uso deste material e potencializar o seu aprendizado**

- 1 Imprima este PDF;
- 2 Destaque com caneta marca-texto as palavras desconhecidas;
- 3 Leia a coluna *meaning* para descobrir o significado, sem usar tradutores;
- 4 Construa frases com aplicação das novas palavras que você está aprendendo.

Se precisar de inspiração, use o [dictionary.cambridge.org](https://dictionary.cambridge.org)

Faça isso por meio da escrita e não da digitação, pois isso potencializa o armazenamento do novo conhecimento na memória de longo prazo.

# Expressões

## Exemplos

<b>Acidulant</b> Acidulante	<b>Citric acid is produced and sold as an acidulant for food and other products.</b> O ácido cítrico é produzido e vendido como acidulante para alimentos e outros produtos.
<b>Acidity regulators</b> Reguladores de acidez	<b>These products always contain acidity regulators and preservatives to extend their shelf life.</b> Esses produtos sempre contêm reguladores de acidez e conservantes para prolongar a vida útil.
<b>Adiabatic</b> Adiabático	<b>If the compression is adiabatic, the gas temperature goes up.</b> Se a compressão for adiabática, a temperatura do gás aumenta.
<b>Boiling point</b> Ponto de ebulição	<b>I also wish to mention the issue of the boiling point.</b> Gostaria também de fazer referência à questão do ponto de ebulição.
<b>Brimstone</b> Enxofre	<b>A brimstone furnace is one of the main installations in sugar production.</b> Um forno de enxofre é uma das principais instalações na produção de açúcar.
<b>Calorimeter</b> Calorímetro	<b>The temperature inside and outside the calorimeter must be the same before the experiment begins.</b> A temperatura dentro e fora do calorímetro deve ser a mesma antes do início da experiência.
<b>Degreasing</b> Desengordurante	<b>If necessary, clean with alcohol or other suitable degreasing fluid.</b> Se necessário, limpe com álcool ou outro fluido desengordurante adequado.
<b>Dew point</b> Ponto de orvalho	<b>As the temperature increases, the dew point often does the same.</b> À medida que a temperatura aumenta, o ponto de orvalho geralmente faz o mesmo.
<b>Effervescence</b> Efervescência	<b>Ash is alkaline, and an effervescence occurs when acid is added.</b> As cinzas são alcalinas e ocorre uma efervescência quando ácido é adicionado.
<b>Flammable</b> Inflamável	<b>The floor was completely covered by flammable goo.</b> O chão estava completamente coberto de substância inflamável.

# Expressões

## Exemplos

<b>Immiscible</b> Imiscível	<b>Oil is immiscible in water.</b> O óleo é imiscível em água.
<b>Ionization</b> Ionização	<b>The proper dose was measured by the ionization chamber.</b> A dose adequada foi medida pela câmara de ionização.
<b>Neutralization</b> Neutralização	<b>An acid-base reaction is often called a neutralization reaction.</b> Uma reação ácido-base é frequentemente chamada de reação de neutralização.
<b>Oxidant</b> Oxidante	<b>Ozone is a powerful oxidant and can be used as a primary disinfectant.</b> O ozônio é um poderoso oxidante e pode ser usado como desinfetante primário.
<b>Qualitative analysis</b> Análise Qualitativa	<b>In spite of the breadth of the sample, an in-depth qualitative analysis of the material was limited.</b> Apesar da amplitude da amostra, uma análise qualitativa aprofundada do material foi limitada.
<b>Refrigerant</b> Refrigerante	<b>Those chemicals are widely used in industry as refrigerants.</b> Esses produtos químicos são amplamente utilizados na indústria como refrigerantes.
<b>Room temperature</b> Temperatura ambiente	<b>This mixture is stable at room temperature for at least 8 weeks.</b> Esta mistura é estável à temperatura ambiente por pelo menos 8 semanas.
<b>Sedimentation</b> Sedimentação	<b>This tank has to have at least 3 chambers to guarantee proper sedimentation.</b> Este tanque deve ter pelo menos três câmaras para garantir uma sedimentação adequada.
<b>Sludge</b> Resíduos	<b>The planned costs for the sludge reduce the costs for the process as a whole.</b> Os custos planejados para o resíduo reduzem os custos do processo como um todo.
<b>Slurry pipeline</b> Mineroduto	<b>The accident was caused by the rupture of the slurry pipeline.</b> O acidente foi causado pela ruptura do mineroduto.

# Expressões

## Exemplos

	<b>Exemplos</b>
<b>Turbidity</b> Turbidez	<p><b>A suitable method for reducing turbidity is a siltation tank.</b> Um método adequado para reduzir a turbidez é um tanque de assoreamento.</p>
<b>Visbreaking</b> Viscoredução	<p><b>The project comprises the building of a visbreaking unit destined for smooth thermal cracking.</b> O projeto compreende a construção de uma unidade de viscoredução destinada a um craqueamento térmico mais suave.</p>
<b>Volatile</b> Volátil	<p><b>It's thought that the blast occurred when volatile chemicals exploded.</b> Pensa-se que a explosão ocorreu quando produtos químicos voláteis explodiram.</p>
<b>Waste incineration</b> Incineração de resíduos	<p><b>In the case of waste incineration, a considerable amount of heavy metals is released.</b> No caso de incineração de resíduos, uma quantidade considerável de metais pesados é liberada.</p>
<b>Working solution</b> Solução de trabalho	<p><b>Apply the working solution at low pressure to surfaces, equipment and appliances.</b> Aplique a solução de trabalho suavemente a superfícies, equipamentos e materiais.</p>

# Glossário

## A

**Acceptable intake**

Numbers which describe how toxic a chemical is. The numbers are derived from animal studies of the relationship between dose and non-cancer effects. There are two types of acceptable exposure values: one for acute (relatively short-term) and one for chronic (longer-term) exposure.

**Acids**

A class of compounds that can be corrosive when concentrated. Weak acids, such as vinegar and citric acid, are common in foods. Strong acids, such as muriatic (or hydrochloric), sulfuric and nitric acid have many industrial uses, and can be dangerous to those not used to handling them. Acids are chemical "opposites" of bases, in that they can neutralize each other.

**Action level**

A guideline established by environmental protection agencies to identify the concentration of a substance in a particular medium (water, soil, etc.) that may present a health risk when exceeded. If contaminants are found at concentrations above their action levels, measures must be taken to decrease the contamination.

**Activated sludge**

A term used to describe sludge that contains microorganisms that break down organic contaminants (e.g., benzene) in liquid waste streams to simpler substances such as water and carbon dioxide. It is also the product formed when raw sewage is mixed with bacteria-laden sludge, then stirred and aerated to destroy organic matter.

**Adsorbates**

Molecules of gas, liquid, or dissolved solids that adhere to surfaces. Differs from absorption, where a substance is taken up or made part of an existing whole.

**Adverse health effects**

Effects of chemicals or other materials that impair one's health. They can range from relatively mild temporary conditions such as minor eye or throat irritation, shortness of breath or headaches to permanent and serious conditions such as cancer, birth defects or damage to organs.

**Advisory level**

The level above which an environmental protection agency suggests it is potentially harmful to be exposed to a contaminant, although no action is mandated.

# Glossário

## Aeration

Passing air through a solid or liquid, often part of a process that promotes breakdown or movement of contaminants in soil or water by exposing them to air.

## Air sparging

Injecting air or oxygen into an aquifer to strip or flush volatile contaminants as air bubbles up through the ground water. The air is captured by a vapor extraction system.

## Air stripping

A treatment system that removes or "strips" volatile organic compounds from contaminated groundwater or surface water by forcing an airstream through the water and causing the compounds to evaporate.

## Air stripping tower

Air stripping removes volatile organic chemicals (such as solvents) from contaminated water by causing them to evaporate. Polluted water is sprayed downward through a tower filled with packing materials while air is blown upwards through the tower. The contaminants evaporate into the air, leaving significantly reduced pollutant levels in the water. The air is treated before it is released into the atmosphere.

## Alkaline

Having the properties of a base, a pH greater than 7. Usually used as an adjective, i.e. "alkaline soil".

## Alluvial deposit

An area of sand, clay or other similar material that has been gradually deposited by moving water, such as along a riverbed or shore of a lake.

## Ambient air

Refers to the surrounding air. Generally, ambient air refers to air outside and surrounding an air pollution source location. Often used interchangeably with "outdoor air."

## Anaerobic

In the absence of oxygen. Some organisms, such as certain soil bacteria, thrive under anaerobic conditions in soil.

## Analyte

A chemical being tested for in a laboratory test.

## Applicable or Relevant and Appropriate Requirements

Federal or state laws, regulations, standards, criteria or requirements which would apply to the cleanup of hazardous substances at a particular site.

## Aqueous

Water-based.

# Glossário

## Aquifer

A water-bearing layer of rock or sediment that is capable of yielding useable amounts of water. Drinking water and irrigation wells draw water from the underlying aquifer.

## Arsenic

A gray, brittle and highly poisonous metal. It is used as an alloy for metals, especially lead and copper, and is used in insecticides and weed killers. In its inorganic form, it is listed as a cancer-causing chemical under Proposition 65.

## Artesian well

A well that flows up like a fountain because of the internal pressure of the aquifer.

## Asbestos

A general name given a family of naturally occurring fibrous silicate minerals. Asbestos fibers were used mainly for insulation and as a fire-retardant material in ship and building construction and other industries, and in brake shoes and pads for automobiles. Inhaling asbestos fibers has been shown to result in lung disease (asbestosis) and in lung cancer (mesothelioma). The risk of developing mesothelioma is significantly enhanced in smokers.

# B

## Backfill

To refill an excavated area with uncontaminated soils; and the material used to refill an excavated area.

## Background concentration, background level

Represents the average amount of toxic chemicals in the air, water or soil to which people are routinely exposed. More than half of the background concentration of toxic air in metropolitan areas comes from automobiles, trucks and other vehicles. The rest comes from industry and business, agricultural, and from the use of paints, solvents and chemicals in the home.

## Bases

A class of compounds that are "opposite" to acids, in that they neutralize acids. Weak bases are used in cooking (baking soda) and cleaners. Strong bases can be corrosive, or "caustic". Examples of strong bases that are common around the house are drain cleaners, oven cleaners and other heavy-duty cleaning products. Strong bases can be very dangerous to tissue, especially the eyes and mouth.

# Glossário

**Bedrock**

The continuous solid rock of the continental crust. Bedrock can be found anywhere from the surface to hundreds of feet below ground. Bedrock can be solid, or it can contain numerous cracks (fractures). Groundwater and chemicals can move through fractured bedrock.

**Bentonite**

A very fine clay, expandible when moist, commonly used to provide a tight seal around a monitoring well. Also used in slurry walls.

**Benzene**

A petroleum derivative widely used in the chemical industry. A few uses are: synthesis of rubber, nylon, polystyrene, and pesticides; and production of gasoline. Benzene is a highly volatile chemical readily absorbed by breathing, ingestion or contact with the skin. Short-term exposures to high concentrations of benzene may result in death following depression of the central nervous system or fatal disturbances of heart rhythm. Long-term, low-level exposures to benzene can result in blood disorders such as aplastic anemia and leukemia. Benzene is listed as a cancer-causing chemical under Proposition 65.

**Berm**

A curb, ledge, wall or mound used to prevent the spread of contaminants. It can be made of various materials, even earth in certain circumstances.

**Bioaccumulation**

The process by which the concentrations of some toxic chemicals gradually increase in living tissue, such as in plants, fish, or people as they breathe contaminated air, drink contaminated water, or eat contaminated food.

**Bioremediation**

A process that uses microorganisms to change toxic compounds into non-toxic ones.

**Biosolids**

Residuals generated by the treatment of sewage, petroleum refining waste and industrial chemical manufacturing wastewater with activated sludge.

**Biodegradation**

Transformation of one chemical into others by microorganisms in the soil.

**Borehole**

A vertical hole drilled into the ground to collect soil samples and analyze for chemical presence and soil characteristics.

# Glossário

## C

**California Environmental Quality Act (CEQA)**

First enacted in 1970 to provide long-term environmental protection, the law requires that governmental decision-makers and public agencies study the significant environmental effects of proposed activities, and that significant avoidable damage be avoided or reduced where feasible. CEQA also requires that the public be told why the lead public agency approved the project as it did and gives the public a way to challenge the decisions of the agency.

**Cancer risk**

A number, generally expressed in exponential form (i.e.,  $1 \times 10^{-6}$ ), which means one in one million, which describes the increased possibility of an individual developing cancer from exposure to toxic materials. Calculations producing cancer risk numbers are complex and typically include a number of assumptions that tend to cause the final estimated risk number to be conservative.

**Cap**

A layer, such as clay or a synthetic material, used to prevent rainwater from penetrating the soil and spreading contamination.

**Carbon adsorption**

A treatment system in which organic contaminants are removed from groundwater and surface water by forcing it through tanks containing activated carbon, a specially treated material that retains such compounds. Activated carbon is also used to purify contaminated air by adsorbing the contaminants as the air passes through it.

**Carbon tetrachloride (CCl<sub>4</sub>)**

A colorless, nonflammable toxic liquid that was widely used as a solvent in dry-cleaning and in fire extinguishers. It is listed as a cancer-causing chemical under Proposition 65.

**Carcinogen**

A cancer-causing substance.

**Chromium**

A hard, brittle, grayish heavy metal used in tanning, in paint formulation, and in plating metal for corrosion protection. It is toxic at certain levels and, in its hexavalent (versus trivalent) form, chromium is listed as a cancer-causing agent under Proposition 65.

**Class I landfill**

A landfill permitted to accept hazardous wastes.

# Glossário

**Clean Air Act**

A federal law passed in 1955 and extensively modified in 1970. It is enforced by the California Air Resources Board and the local air quality management or air pollution control districts, as well as by U.S. EPA nationally.

**Clean Water Act**

A federal law of 1972 enforced by U.S. EPA. A key provision is that "any person responsible for the discharge of a pollutant or pollutants into any waters of the United States from any point source must apply for and obtain a permit." This is reflected by the National Pollutant Discharge Elimination System (NPDES), through which the permits are issued by Regional Water Quality Control Boards. Permits are now being required for stormwater runoff from cities and other locations.

**Combustible vapor mixture**

The composition range over which air containing vapor of an organic compound will burn or even explode when set off by a flame or spark. Outside that range the reaction does not occur, but the mixture may nevertheless be hazardous because it does not contain enough oxygen to support life, or because the vapor is toxic.

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

Also known as Superfund, this Federal law authorizes U.S. EPA to respond directly to releases of hazardous substances that may endanger public health or the environment. The Superfund Amendments and Reauthorization Act of 1986 (SARA), amended and reauthorized CERCLA for five years at a total funding level of \$8.5 billion. SARA also strengthened state involvement in the cleanup process and encouraged the use of new treatment technologies and permanent solutions. CERCLA has since been extended by other laws. In particular, SARA Title III is known as the Emergency Planning and Community Right-to-Know Act of 1986. It requires each state to have an emergency response plan as described, and any company that produces, uses or stores more than certain amounts of listed chemicals must meet emergency planning requirements, including release reporting.

**Concentration**

The amount of one substance in another substance. For example, a concentration of 10 milligrams per liter means there are 10 milligrams of a substance in 1 liter of another substance.

# Glossário

**Consent decree**

A legal document, approved and issued by a judge, formalizing an agreement between DTSC and the parties potentially responsible for site contamination. The decree describes cleanup and other actions that the potentially responsible parties are required to perform and the costs incurred by the government that they will reimburse, together with the roles, responsibilities and enforcement options that the government may exercise in the event of non-compliance. If a settlement between DTSC and a potentially responsible party includes cleanup actions, it must be in the form of a consent decree, which is subject to a public comment period.

**Confining layer**

A layer or bed of impermeable or distinctly less permeable material lying below or above one or more aquifers. When the confining layer lies between two aquifers, it keeps water from the upper aquifer separated, or confined, from water in the lower aquifer.

**Containment**

Enclosing or containing hazardous substances in a structure to prevent the migration of contaminants into the environment.

**Contaminant**

Any physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water, or soil.

**Corrosivity**

A characteristic of acidic and basic hazardous wastes. The characteristic is defined by a waste's pH and its ability to corrode steel. A waste is corrosive if it has a pH less than or equal to 2.0 or greater than or equal to 12.5.

**Criteria pollutants**

Air pollutants for which standards for safe levels of exposure have been set under the Clean Air Act. Current criteria pollutants are sulfur dioxide, particulate matter, carbon monoxide, nitrogen oxides, ozone and lead.

**Cumulative impact**

The term cumulative impact is used in several ways: as the effect of exposure to more than one compound; as the effect of exposure to emissions from more than one facility; the combined effects of a facility and surrounding facilities or projects on the environment; or some combination of these.

# Glossário

## D

<b>Deed notice</b>	A notice on a property deed to alert future buyers about contamination on the property.
<b>Deed restriction</b>	A legal restriction placed on a property deed to restrict future uses of a contaminated property. For example, a deed restriction may prohibit future housing development on a contaminated industrial site or prohibit use of contaminated groundwater on a piece of property.
<b>Degrease</b>	To remove grease from machinery, tools, etc., usually using solvents. Aqueous (water-based) cleaners are becoming popular and are required in some parts of the state.
<b>Dense non-aqueous phase liquid</b>	A liquid that is denser than water and does not dissolve or mix easily in water (is immiscible). Many chlorinated solvents such as trichloroethylene are DNAPLs.
<b>Deionized water</b>	Water that has had its ions removed, resulting in very low conductivity, used to provide high purity for applications in laboratories, pharmaceuticals, and electronics manufacturing, preventing interference in chemical reactions.
<b>Department of Toxic Substances Control (DTSC)</b>	A California Environmental Protection Agency department responsible for regulating hazardous waste and overseeing the investigation and cleanup of hazardous waste sites.
<b>Desorption</b>	The opposite of adsorption or absorption; molecules detach from a surface (such as soil particles).
<b>Destruction and removal efficiency (DRE)</b>	A percentage that represents the number of molecules of compound removed or destroyed in an incinerator relative to the number of molecules that entered the incinerator system. A DRE of 99.99 percent means that 9,999 molecules of a compound are destroyed for every 10,000 molecules that enter the system. For some compounds a DRE of 99.9999 is required.
<b>Detection limit</b>	The lowest concentration of a chemical that can be reliably measured by a given laboratory testing method.
<b>Dewater</b>	To remove water from wastes, soils or chemicals.

# Glossário

**Dioxins**

Toxic chemical compounds formed as byproducts in industrial processes such as waste incineration. They are highly persistent in the environment and can accumulate in the food chain, posing health risks such as cancer and immune system damage.

**Downgradient**

The direction of flow or movement of groundwater or contaminants in relation to the topography, specifically toward lower elevation areas.

**Drawdown**

The vertical drop in the height between the water level in a well prior to pumping, and the water level in the well during pumping.

**Dual-Phase Vacuum Extraction System**

A treatment system designed to remove both contaminated groundwater and soil gas from a common groundwater well or wells. By removing groundwater, the system lowers the groundwater level around the well, allowing a strong vacuum to be applied to remove contaminated soil gas. The contaminated water and air can then be removed or treated and released.

**Duplicate Sample (Dupe)**

A sample taken at the same location as another sample. Both samples are tested for chemicals. Taking a duplicate sample helps to ensure that testing procedures are precise: because the samples were taken in the same location, the samples should contain similar levels of chemicals.

**E****Effluent**

Wastewater treated or untreated, that flows out of a treatment plant, sewer or industrial outfall. Generally, refers to wastes discharged into surface waters.

**Estuary**

Areas where fresh water from rivers mixes with saltwater from nearshore ocean. They include bays, mouths of rivers, salt marshes and lagoons. These brackish water ecosystems shelter and feed marine life, birds and wildlife.

**Ethylene glycol**

Used in the manufacture of a wide variety of industrial compounds and in certain cosmetics. It is used most commonly as an automobile antifreeze. It is toxic.

# Glossário

## Exposure pathways

Existing or hypothetical routes by which chemicals in soil, water or other media can come in contact with humans, animals or plants.

## Extraction wells

Wells that are used primarily to remove contaminated groundwater from the ground. Water level measurements and water samples can also be collected from extraction wells.

## Ex-situ

Outside the original location. For example, contaminated soil is dug up and removed before it is treated is being treated ex-situ. This is the opposite of in-situ.

## Extraction well

A discharge well used to remove contaminated groundwater or air.

# F

## Feasibility study

An assessment to determine the practicality and viability of a proposed project or remediation strategy.

## Flammables

A class of compounds that ignite easily and burn rapidly. The Department of Transportation requires that Vehicles transporting flammables must have special markings (placards).

## Footprint

The outline of an area within which hazardous substances are suspected or known to exist.

# G

## Gas venting system

A system of pipes and vents installed in a landfill to prevent the build up of landfill gases, such as methane, that could potentially explode. Sometimes the gas vents have flares on them to burn the gas as it is released into the atmosphere. At some very large landfills, the gas is collected and used to generate electricity.

## Geomembrane

A low permeability plastic sheet that is placed over a landfill to deter rain and snow from entering a landfill's waste. Geomembranes are often made from a plastic called HDPE (high density polyurethane). The geomembrane is covered with soil (barrier protection layer) and topsoil to protect it.

# Glossário

<b>Geophysical logging</b>	Measurement and analysis of electrical, acoustic, nuclear, and other physical properties in a borehole using wireline or direct push technology.
<b>Geoprobe™</b>	A brand name for a series of drilling and sampling equipment used for environmental site investigations.
<b>Gram(g)</b>	The unit of mass in the metric system. An ounce is about 28 grams, and a pound is approximately 450 grams.
<b>Granular activated carbon (GAC)</b>	A form of crushed and hardened charcoal. GAC has a strong potential to attract and absorb volatile organic compounds from extracted groundwater and gases.
<b>Groundwater</b>	Water found beneath the earth's surface that fills pores between soil particles such as sand, clay, and gravel or that fills cracks in bedrock. Precipitation that does not evaporate or runoff to surface waters percolates downward through soil and becomes groundwater. Groundwater flows from areas of high elevation to low elevation at generally low velocities (usually ranging from 10-1000 feet/year) and eventually discharges into surface waters such as rivers, lakes, and wetlands. Groundwater often provides a source of drinking water via wells. The chemical composition of the groundwater reflects the soil or bedrock through which it passes; groundwater dissolves minerals in the soil and bedrock. If a source of contamination exists at or below the earth's surface, percolating rainfall or snowmelt can transport contaminants downward where they can migrate with the groundwater.
<b>Groundwater collection/ extraction and treatment system</b>	A system of wells fitted with pumps and piping used to pump out or extract contaminated groundwater from the subsurface. Properly designed and operated systems can effectively contain a groundwater contaminant plume and prevent further contaminant migration.
<b>Halogens</b>	The family of elements that includes fluorine, chlorine, bromine and iodine. Halogens are very reactive and have many industrial uses. They are also commonly used in disinfectants and insecticides. Many hazardous organic chemicals -- such as polychlorinated biphenyls (PCBs), some volatile compounds (VOCs) and dioxins contain halogens, especially chlorine.



# Glossário

**Hazardous Substance**

Under the Comprehensive Environmental Response, Compensation, and Liability Act, a hazardous substance is any element, compound, mixture, solution, or substance that, when released to the environment, may present a substantial danger to the public health or welfare or to the environment, including, but not limited to, toxic and certain other pollutants under the Federal Water Pollution Control Act, Resource Conservation and Recovery Act, hazardous air pollutants regulated by parts of the Clean Air Act, and Toxic Substance Control Act. The term is much broader than the term hazardous waste. Sites that contain only hazardous substances are excluded from New York's Superfund program.

**Hazardous waste**

Waste substances which can pose a substantial or potential hazard to human health or the environment when improperly managed. Hazardous waste possesses at least one of these four characteristics: ignitability, corrosivity, reactivity or toxicity; or appears on special U.S. EPA lists.

**Health risk/endangerment assessment**

A study prepared to assess health and environmental risks due to potential exposure to hazardous substances.

**Health-based remediation targets**

Measurable health, water quality or performance objectives that are established based on a judgement of safety and on risk assessments of waterborne hazards.

**Health and safety plan**

A plan included in investigation or cleanup work plans which outlines protective measures for site workers and the community during investigation or cleanup activities.

**Heavy metals**

A group of elements (such as chromium, lead, copper and zinc) that can be toxic at relatively low concentrations and tend to accumulate in the food chain.

**Horizontal wells**

Extraction and monitoring wells are typically drilled vertically. A horizontal well has the advantage of providing a large area of groundwater capture for a lower overall cost.

# Glossário

## Hydraulic gradient

In general, the direction of groundwater flow due to changes in the depth of the water table. Just as water flows downhill, water in the ground moves from areas of high elevation to areas of low elevation. The slope of the water table is the hydraulic gradient. The hydraulic gradient determines the speed of groundwater flow. A steep gradient causes groundwater to move faster than a nearly horizontal gradient.

## Hydrocarbon

An organic chemical compound of hydrogen and carbon in either gaseous, liquid, or solid phase. The molecular structure of hydrocarbon compounds varies from the simple (eg, methane, a constituent of natural gas) to the very heavy and very complex.

## Hydrochloric acid

Clear, colorless and acidic solution of hydrogen chloride in water often used in metal cleaning and electroplating. Many hazardous wastes contain chlorine compounds which create small amounts of hydrogen chloride when they are burned. This can contribute to the formation of acid rain. Regulations require that air pollution control equipment remove either 99% of the hydrochloric acid, or that the emissions contain less than four pounds per hour.

## Hydrogen Release Compound (HRC™)

Hydrogen Release Compound (HRC™) is a passive treatment option for bioremediation of chlorinated solvents. HRC™ is injected into contaminated soils. Naturally occurring microbes metabolize lactic acid released by HRC™ and produce hydrogen. The resulting hydrogen can be used to break down the chlorinated solvents. The process requires anaerobic conditions. Major target compounds include perchloroethene, trichloroethene, and trichloroethane as well as their breakdown products.

## Hydrogeology

The geology of groundwater, with particular emphasis on the chemistry and movement of water.

## Hydrology

The study of the movement and properties of water on the earth's surface, underground and in the atmosphere.

## I

## Impermeable

Unable to be penetrated, as by liquids. For example, an "impermeable membrane" can be a thin plastic sheet through which rainwater cannot move.

# Glossário

## In-situ

Treatment or assessment methods conducted at the original site of contamination. It is carried out without moving soil or displacing existing structures or buildings, such as soil vapour extraction.

## In-situ soil aeration

Applying a vacuum to vapor extraction wells to draw air through the soil so that chemicals in the soil are brought to the surface where they can be treated.

## Indicator chemicals

Specific substances used to indicate the presence of contamination or assess the effectiveness of remediation.

## Interim Remedial Action Plan (IRAP)

A plan outlining cleanup actions taken to protect public health and the environment while long-term solutions are being developed.

## Irritant

A chemical that can cause temporary irritation at the site of contact.

## J

## Jackson turbidity unit (JTU)

A measure of the turbidity of water, proportional to the ppm silica, where 100 ppm silica equals 21.5 JTU. This method was the standard for turbidity for many years; it applied the use of a candle, measuring tube, and the human eye for determining the value. This method has since been replaced by the use of a known turbidity standard, Formazin, and the use of analytical instruments that will detect forward-scattered light and light scattered at 90 degrees.

## L

## Leachate

Typically, water that has come in contact with hazardous wastes. For example: Water from rain or other sources that has percolated through a landfill and dissolved or carries various chemicals, and thus could spread contamination. Current landfills have systems to collect leachate before that can happen.

# Glossário

**Lead**

A heavy metal present in small amounts everywhere in the human environment. Lead can get into the body from drinking contaminated water, eating vegetables grown in contaminated soil, or breathing dust when children play or adults work in lead-contaminated areas or eating lead-based paint. It can cause damage to the nervous system or blood cells. Children are at highest risk because their bodies are still developing. Lead and its compounds are listed as a reproductive toxic substance for women and men, and a cancer-causing substance under Proposition 65.

**Light non-aqueous phase liquid**

Liquids lighter than water that represent a special class of soil and groundwater contaminants with unique behavior and problems.

**M****Magnetometer/ magnetometer survey**

A non-invasive, passive potential field technique that measures localized perturbations to the Earth's magnetic field and anomalies caused by the presence of naturally occurring buried mineral deposits and geologic structures, and manmade ferrous materials.

**Maximum contaminant level (MCL)**

A contaminant level for drinking water, established by the California Department of Health Services, Division of Drinking Water and Environmental Management, or by the U.S. Environmental Protection Agency. These levels are legally enforceable standards based on health risk (primary standards) or non-health concerns such as odor or taste (secondary standards).

**Mercury**

Also known as "quicksilver," this metal is used in the paper pulp and chemical industries, in the manufacture of thermometers, and thermostats, and in fungicides. Mercury exists in three biologically important forms, elemental, inorganic and organic. It is highly toxic and affects the nervous system, kidneys and other organs. It also accumulates in animals that are high in the food chain (predators). Organic mercury compounds are the most toxic, and transformations between the three forms of mercury do occur in nature.

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## Methane

An odorless, colorless, flammable gas that is the major constituent of natural gas. It can be formed from rotting organic matter (i.e., trash in a landfill), and seep up through soils or migrate through underground piping to the surface. It also seeps up through the ground in areas that have shallow petroleum deposits or improperly abandoned oil wells, such as certain areas of the Los Angeles Basin. If it collects in a closed space and reaches certain concentrations, a spark can cause an explosion. It can also displace air and cause a suffocation hazard in low, enclosed spaces. This is one of the reasons landfill gas is collected and burned, sometimes for generation of electricity.

## Microgram per gram ( $\mu\text{g/g}$ )

A measurable unit of concentration for a solid. A mercury level of 1.0  $\mu\text{g/g}$  means that one microgram (one millionth of a gram) of mercury was detected in one gram of sample. It is equivalent to one part per million.

## Milligram per cubic meter ( $\text{mg/m}^3$ )

A unit of concentration for air contaminants. A mercury vapor level of 1.0  $\text{mg/m}^3$  means that one milligram (one thousandth of a gram) of mercury vapor was detected in each cubic meter of sampled air.

## Milligram per kilogram (mg/kg)

A unit of concentration for a solid. A mercury level of 1.0 mg/kg in fish means that one milligram (one thousandth of a gram) of mercury was found in each kilogram of sampled fish. (A kilogram is 1,000 grams or approximately 2.2 pounds). Also equals one part per million.

## Migration

The movement of chemical contaminants through soils or groundwater.

## Mitigation

Actions taken to improve site conditions by limiting, reducing or controlling hazards and contamination sources.

## Monitoring wells

Specially constructed wells used exclusively for testing water quality.



## National Pollutant Discharge Elimination System (NPDES)

A system under the federal Clean Water Act that requires a permit for the discharge of pollutants to surface waters of the United States. In California, NPDES permits are obtained from the Regional Water Quality Control Board.

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**National Priorities List (NPL)**

The U.S. Environmental Protection Agency's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response using money from a special trust fund (Superfund).

**Natural attenuation**

Natural (physical, chemical, or biological) processes that reduce mass, toxicity, mobility, volume, or concentration of compounds in earth or groundwater. Under proper conditions, can be used for perchloroethylene (PCE), trichloroethylene (TCE), and trichloroethane (TCA) at a lower cost than conventional remediation technologies.

**Negative Declaration**

A California Environmental Quality Act document issued by the lead regulatory agency when the initial environmental study reveals no substantial evidence that the proposed project will have a significant adverse effect on the environment, or when any significant effects would be avoided or mitigated by revisions agreed to by the applicant.

**Nickel**

A metal used in alloys to provide corrosion and heat resistance for products in the iron, steel and aerospace industries. Nickel is used as a catalyst in the chemical industry. It is toxic and, in some forms, is listed as a cancer-causing agent under Proposition 65.

**Nitrate**

Formed when ammonia is degraded by microorganisms in soil or groundwater. This compound is usually associated with fertilizers.

**Non-aqueous phase liquids (NAPL)**

Liquids, commonly a mixture of several different chemicals, that are either denser or less dense than water. Dense NAPL (DNAPL), such as chlorinated solvents, will sink if it enters groundwater; less dense, or light NAPL (LNAPL), such as gasoline, will float on the water table. NAPL in the subsurface can be a persistent source of groundwater contamination due to its low solubility and viscosity.

**Overburden**

The rock and soil in the ground above bedrock.

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## Oxidizers

A group of chemicals that are very reactive, often but not always supplying oxygen to a reaction. Some oxidation reactions can release large amounts of heat and gases, and, under the right conditions, cause an explosion. Others can cause rapid corrosion of metal, damage to tissue, burns and other serious effects. Examples of oxidizers include chlorine gas, nitric acid, sodium perchlorate, and ammonium nitrate.

## Ozone and ozonation

Ozone is a reactive form of oxygen (O<sub>3</sub>) that reacts with volatile organic compounds (VOCs) to change them into chemicals which pose no potential threat to human health, by breaking them down to form carbon dioxide and water. Ozonation is the process of treating water with ozone to disinfect and remove contaminants.

# P

## Particulates

Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog, found in air or emissions.

## Parts per million (ppm)

A measuring unit for the concentration of one material in another. When looking at contamination of water and soil, the toxins are often measured in parts per million. One part per million is equal to one thousandth of a gram of substance in one thousand grams of material. One part per million would be equivalent to one drop of water in twenty gallons. See milligrams per kilogram.

## Parts per billion (ppb)

A unit of measure used to describe levels or concentrations of contamination. A measure of concentration, equaling 0.0000001 percent. For example, One part per billion is the equivalent of one drop of impurity in 500 barrels of water. Most drinking water standards are ppb concentrations.

## Perched groundwater

Water that accumulates beneath the earth's surface but above the main water bearing zone (aquifer). Typically, perched groundwater occurs when a limited zone (or lens) of harder, less permeable soil is "perched" in otherwise porous soils. Rainwater moving downward through the soil stops at the lens, flows along it, then seeps downward toward the aquifer.

## Perchloroethylene (PCE)

A volatile organic compound used primarily as a dry-cleaning agent. It is often referred to as "perc." It is toxic and listed as a cancer-causing chemical under Proposition 65.

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## Percolation

The downward flow or filtering of water or other liquids through subsurface rock or soil layers, usually continuing to groundwater.

## Petrochemicals

Chemical substances produced from petroleum in refinery operations. Many are hazardous.

## pH

A convenient way of describing the strength of an acidic or basic aqueous solution. The values range from 0 to 14, with a pH of 7 corresponding to neutral. As the pH number becomes smaller by one unit, the acidity increases by a factor of 10 (for 2 units, it changes by 100, and so on). Likewise, as the pH number increases by one unit, the alkalinity (basic property) increases by a factor of 10, etc.; tap water may lie in a region from above 6 to below 8. Strongly acidic waste solutions (pH less than 2) and strongly basic ones (pH greater than 12.5) are defined as hazardous wastes because of their corrosive effect on metals and on skin.

## Phenols

Organic compounds used in plastics manufacturing, tanning, and textile, dye and resin manufacturing. They are by-products of petroleum refining. In general, they are highly toxic.

## Piezometers

An instrument used to measure the elevation of the water table, i.e. how far below the surface groundwater is located.

## Pilot study

A study of a possible cleanup alternative during the Feasibility Study for a specific site. It is used to gather data necessary for the final selection of the cleanup method.

## Plume

An area of chemicals moving away from its source in a feather-like (hence the name, plume) shape. Often a body of contaminated groundwater flowing from a specific source, the movement of which is influenced by such factors as local groundwater flow patterns, the character of the aquifer in which the groundwater is contained, and the density of contaminants. A plume may also be a cloud of smoke or vapor. It defines the area where exposure would be dangerous.

## Polychlorinated biphenyls (PCBs)

A group of toxic chemicals used for a variety of purposes including electrical applications, carbonless copy paper, adhesives, hydraulic fluids, and caulking compounds. PCBs do not breakdown easily and are listed as cancer-causing agents under Proposition 65.

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**Polynuclear aromatic hydrocarbons (PAHs or PNAs)**

PNAs or Polynuclear Aromatic Hydrocarbons, are natural constituents of crude oil, and also may be formed when organic materials such as coal, oil, fuel, wood or even foods are not completely burned. PNAs are also found in lampblack, a by-product of the historic gas manufacturing process. PNAs are found in a wide variety of other materials, including diesel exhaust, roofing tars, asphalt, fireplace smoke and soot, cigarettes, petroleum products, some foods, and even some shampoos. PNAs tend to stick to soil and do not easily dissolve in water, and generally do not move in the environment. The test method used to analyze for PNAs detects seventeen different compounds. Of the seventeen, seven are suspected of causing cancer in humans.

**Polyvinyl chloride (PVC)**

A plastic made from the gaseous chemical vinyl chloride. PVC is used to make pipes, records, raincoats and floor tiles. It produces hydrochloric acid when burned. Health risks from high concentrations of vinyl chloride (not the polymer) include liver cancer and lung cancer, as well as cancer of the lymphatic and nervous systems. Vinyl chloride (not the polymer) is listed as a cancer-causing chemical under Proposition 65.

**Potentially Responsible Party (PRP)**

An individual, company or government body identified as potentially liable for a release of hazardous substances to the environment. By federal law, such parties may include generators, transporters, stores and disposers of hazardous waste, as well as present and past site owners and operators.

**Pretreatment unit**

A wastewater treatment unit that is designed to treat wastewater that does not meet the sewage discharge standards so that it meets or exceeds those standards. Pretreatment units usually require a permit from a local agency.

**Principal organic hazardous constituents (POHCs)**

The primary organic chemicals that pose significant risk to human health and the environment in hazardous waste.

**Pump test**

A field test by which a well is pumped for a period of time and data are collected for use in assessing characteristics of subsurface water-bearing zones, or aquifers.

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## Q

**Quality assurance  
quality control  
(QA)/(QC)**

A system of procedures, checks, audits, and corrective actions to ensure that environmental sampling and testing are of the highest achievable quality.

## R

**Radon**

A gaseous, radioactive alpha particle-emitting element with a half-life of about four days. Radon exists naturally in many locations and may present a serious health risk when it accumulates in basements or crawl spaces beneath homes.

**Reactive**

A class of compounds which are normally unstable and readily undergo violent change, react violently with water, can produce toxic gases with water, or possess other similar properties. Reactivity is one characteristic that can make a waste hazardous.

**Regional Water  
Quality Control  
Board (RWQCB)**

A state agency in the U.S. that maintains water quality standards for areas within its jurisdictions and enforce water quality laws.

**Remedial Action  
Plan (RAP)**

A comprehensive program for the cleanup (remediation) of a contaminated site, including investigation, analysis, and implementation of a cleanup plan.

**Remedial  
Investigation/  
Feasibility Study  
(RI/FS)**

A series of investigations and studies to identify the types and extent of chemicals of concern at the site and to determine cleanup criteria (Remedial Investigation), and to provide an evaluation of the alternatives for remediating any identified soil or groundwater problems (Feasibility Study).

**Remediation**

Cleanup of a site to levels determined to be health-protective for its intended use.

**Remedial Action  
Plan (RAP)**

A comprehensive program for the cleanup (remediation) of a contaminated site, including investigation, analysis, and implementation of a cleanup plan.

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## Resource Conservation and Recovery Act (RCRA)

A 1976 amendment to the first federal solid waste legislation, the Solid Waste Disposal Act of 1965. In RCRA, Congress established initial directives and guidelines for U.S. EPA to regulate and manage solid waste, including hazardous waste. RCRA established a regulatory system to track hazardous substances from the time of generation to final disposal. The law requires safe and secure procedures to be used in treating, transporting, storing and disposing of hazardous wastes. RCRA was designed to prevent new, uncontrolled hazardous waste sites.

## Responsible party

An individual or corporate entity considered legally liable for contamination found at a property and, therefore, responsible for cleanup of the site.

## Risk assessment

A risk assessment looks at the chemicals detected at a site, the frequency and concentration of detected chemicals, the toxicity of the chemicals and how people can be exposed, and for how long. Routes of exposure to people are generally through ingestion, such as eating, contact with the skin, or inhalation. The most significant potential routes of exposure are through ingestion and contact with the skin. Based on the standard risk assessment guidelines established for use nationwide by U.S. EPA, exposures for an on-site resident are generally assumed to be daily contact over a 30-year period starting with children ages 0-6, and continuing from 6-30 years. The health risk assessment cannot predict health effects; it only describes the increased possibility of adverse health effects, based on the best scientific information available.

## S

### Sampling

Small amounts of air, water, or soil are obtained and tested to determine the levels of different hazardous chemicals contained in them.

### Sanitary landfill

A landfill which does not take hazardous waste, often called a "garbage dump." It must be covered with dirt each day to maintain sanitary conditions. The Integrated Waste Management Board regulates these facilities.

### Saturated zone

A subsurface area in which all pores and cracks in rock and/or soil are filled with water.

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## Scrubber

A device for removing unwanted gases or particles from an air stream by spraying the air with liquid (usually water) or forcing air through a series of baths. Scrubbers are often put on smokestacks.

## Secondary containment

A structure designed to capture spills or leaks, as from a container or tank, to prevent the release of contaminants. For containers and aboveground tanks, it is usually a beamed area of coated concrete. For underground tanks, it may be a second, outer, wall or a vault. Construction of such containment must meet certain requirements, and periodic inspections are required.

## Sediment

The soil, sand and minerals at the bottom of surface waters, such as streams, lakes and rivers. Sediments capture or adsorb contaminants. The term may also refer to solids that settle out of any liquid.

## Semi volatile organic compounds (SVOCs)

Compounds that evaporate slowly at normal temperatures.

## Sinkhole

A depression formed when the surface collapses into a cavern.

## Site mitigation process

The regulatory and technical process by which hazardous waste sites are identified and investigated, and cleanup alternatives are developed, analyzed, decided upon and applied.

## Site work plan

The site work plan describes the technical activities to be conducted during the various phases of a remediation project.

## Slurry

A mixture of water and solid particles, often used in drilling and construction processes.

## Slurry wall

Barriers used to contain the flow of contaminated groundwater or subsurface liquids. Slurry walls are constructed by digging a trench around a contaminated area and filling the trench with a material that tends not to allow water to pass through it. The groundwater or contaminated liquids trapped within the area surrounded by the slurry wall can be extracted and treated.

## Soil borings

Soil samples taken by drilling a hole in the ground.

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**Soil gas survey**

Soil gas or (soil vapor) is air existing in void spaces in the soil between the groundwater and the ground surface. These gases may include vapor of hazardous chemicals as well as air and water vapor. A soil-gas survey involves collecting and analyzing soil-gas samples to determine the presence of chemicals and to help map the spread of contaminants within soil.

**Soil vapor extraction (SVE)**

A process in which chemical vapors are extracted from the soil by applying a vacuum to wells. An in-situ remediation technique that applies a vacuum to a series of wells ("vapor extraction wells") and induces air flow through contaminated soil. As the air migrates through the soil, volatile organic compounds (VOCs) volatilize (evaporate) and move with the air to the extraction wells where they are removed from the subsurface. If the concentration of VOCs in the extracted air is high, the air maybe treated by a carbon adsorption system before being released to the atmosphere. In some cases, dual phase vacuum extraction is used to treat both groundwater and the overlying soil.

**Solidification**

Mixing additives, such as fly ash or cement, with soil containing hazardous chemicals, especially metals, to make it more stable. This process lessens the risk of exposure to the hazardous chemicals by making it less likely that those chemicals will move into and through surface or groundwater.

**Soluble Threshold Limit Concentration (STLC)**

The limit concentration for toxic materials in a sample that has been subjected to the California Waste Extraction Test (WET), a state test for the toxicity characteristic that is designed to subject a waste sample to simulated conditions of a municipal waste landfill. If the concentration of a toxic substance in the special extract of the waste exceeds this value, the waste is classified as hazardous in California. This is distinct from the Total Threshold Limit Concentration (TTLC). The California Waste Extraction Test procedure is more stringent than the federal Toxicity Characteristic Leaching Procedure (TCLP).

**Solvent**

A liquid capable of dissolving another substance to form a solution. Water is sometimes called "the universal solvent" because it dissolves so many things, although often to only a very small extent. Organic solvents are used in paints, varnishes, lacquers, industrial cleaners and printing inks, for example. The use of such solvents in coatings and cleaners has declined over the last several years, because the most common ones are toxic, contribute to air pollution and may be fire hazards.

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<b>Stabilization</b>	Changing active organic matter in sludge into inert, harmless material. The term also refers to physical activities such as compacting and capping at sites that limits the further spread of contamination without actual reduction of toxicity.
<b>Suggested No Adverse Response Level (SNARL)</b>	Drinking water standards established by the U.S. EPA, but not enforceable by law. SNARLs suggest the level of a containment in drinking water at which adverse health effects would not be anticipated (with a margin of safety).
<b>Sump</b>	A pit or tank that catches liquid runoff for drainage or disposal.
<b>Superfund</b>	Federal and state programs to investigate and clean up inactive hazardous waste disposal sites. The federal program gives the U.S. Environmental Protection Agency the funding and authority to investigate, rank and conduct or supervise cleanup of sites on the National Priority List. New York State's program gives DEC the same authority to deal with sites that do not qualify for the federal superfund list but meet certain other qualifications.
<b>Superfund Amendments and Reauthorization Act (SARA)</b>	Modifications to CERCLA enacted in 1986. Sometimes referred to as the "Right to Know Law," it requires, among other things, that industry provide the government with information on the use and release of certain chemicals into the environment. This information is then made available to the public.
<b>Surge tanks</b>	A tank used to absorb irregularities in flow of liquids, including liquid waste materials, so that the flow out of the tank is constant.

## T

<b>Tetrachloroethylene (TCE)</b>	Volatile organic compound that is commonly used as an industrial degreasing solvent. TCE affects the central nervous system and is listed as a cancer-causing chemical under Proposition 65.
<b>Tetra chlorophenol (TCP)</b>	Tetra chlorophenol is a toxic fungicide, used as a pesticide and disinfectant, associated with environmental contamination.
<b>Toluene</b>	Toxic volatile organic compound often used as an industrial solvent and in the production of gasoline.

# Glossário

**Toxic Substances Control Act (TSCA)**

A federal law of 1976 to regulate chemical substances or mixtures that may present an unreasonable risk of injury to health or the environment.

**Toxicity**

Ability to harm human health or environment.

**U****Unconfined aquifer**

An aquifer in which water is not contained by an impermeable layer of rock or soil. The water level in the aquifer may rise or fall according to the volume of water stored, which varies according to seasonal cycles of natural recharge.

**Underground Storage Tank (UST)**

Underground tank made of steel or fiberglass commonly used to store gasoline and diesel products.

**Unsaturated zone**

Underground soil and gravel that could contain groundwater but lies above the aquifer. This is in contrast to a saturated zone, where the space between soil particles is filled with water.

**Upgradient**

The direction from which water flows in an aquifer. In particular, areas that are higher than contaminated areas and, therefore, are not prone to contamination by the movement of polluted groundwater.

**V****Vadose Zone**

The unsaturated zone which occurs above the water table where the soil pores are only partially filled with water (the moisture content is less than the porosity). This zone is limited above by the land surface and below by the surface of the saturated zone, that is, the water table.

**Video logging**

A method for close-up inspection of the interior of a well or pipe by means of a color camera that can view the well casing and screen at 90 degrees to the well's axis.

**Vinyl chloride**

Vinyl chloride is widely used in the plastics industry in creating polyvinyl chloride (PVC). It is listed as a cancer-causing agent under Proposition 65.

# Glossário

## Viscosity

A measure of the ease with which a liquid can be poured or stirred. The higher the viscosity, the less easily a liquid pours.

## Void space

The space in a tank between the top of a tank and the liquid level. If the tank is used to store combustible liquids that easily evaporate, this space can fill with vapors which may reach explosive levels.

## Volatile

Describes substances that readily evaporate at normal temperatures and pressures.

## Volatile organic compounds (VOCs)

Organic liquids, including many common solvents, that readily evaporate at temperatures normally found at ground surface and at shallow depths. They take part in atmospheric photochemical (lights-driven) reactions to produce smog.

## W

### Water table

In a shallow aquifer, a water table is the depth at which free water is first encountered in a monitoring well. The boundary between the unsaturated zone and the saturated zone. The water table generally reflects surface topography and varies with changes in land surface elevations.

### Watershed

Land area that channels rainfall and snowmelt to creeks, streams, and rivers, and eventually to outflow points such as reservoirs, bays, and the ocean.

## X

### Xylene

An aromatic hydrocarbon used in gasoline, paints, lacquers, pesticides, gums, resins and adhesives. It is toxic and flammable.

## Z

### Zinc

A metal used for auto parts, for galvanizing, and in production of brasses and dry cell batteries. It is nutritionally essential but toxic at higher levels.

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