Glossary: Printed from Interstate Technology & Regulatory Council (ITRC). 2018. TPH Risk Evaluation at Petroleum-Contaminated Sites. THPRisk-1. Washington, D.C.: Interstate Technology & Regulatory Council, TPH Risk Evaluation Team. https://tphrisk-1.itrcweb.org

Glossary

A

Absorption
The assimilation or incorporation of a gas, liquid, or dissolved substance into another substance.

Acceptance limits
The specifications and acceptance/rejection criteria, such as acceptable quality level and unacceptable quality level, with an associated sampling plan that are necessary for deciding to accept or reject a lot or batch of raw material, intermediate, packaging material, or active pharmaceutical ingredient. This term can also be applied to validation.

Acute to chronic ratio (ACR)
A standard measure of the acute toxicity of a material divided by an appropriate measure of the chronic toxicity of the same material under comparable conditions.

Aliphatic range
Any chemical compound belonging to the organic class in which the atoms are not linked together to form a ring. In this case pertaining specifically to non-ring structure components of petroleum products, such as alkanes (e.g., pentane, having a 5-carbon chain fully saturated with hydrogen) and alkenes (e.g., butane, having a 4-carbon chain fully saturated with hydrogen).

Aliphatics
Acyclic or cyclic, saturated or unsaturated carbon compounds, excluding aromatic compounds.

Alkanes
A group of chemicals (also known as paraffins or aliphatic hydrocarbons) for which the carbon atoms are all linked by single covalent bonds.

Alkenes
A group of chemicals (also known as paraffins or aliphatic hydrocarbons) for which the carbon atoms contain at least one double bond.

Alkylation
The transfer of an alkyl group from one molecule to another.

Alkylation reaction
Reaction in which an alkyl group is introduced into a molecule.

Alkynes
A group of open-chain or unsaturated hydrocarbons (such as acetylene) having one or more triple bonds.

Anaerobic
A biological process which occurs in the absence of oxygen.

Analyte
The element, ion, or compound that an analysis seeks to identify; the element of interest.

Aromatic
Organic compounds that are unsaturated. Examples of aromatic hydrocarbons include benzene, toluene, ethylbenzene and xylenes.

Aromatic range
Any organic chemical compound in which the atoms are linked to form at least one ring structure. In this case pertaining, for example, to BTEX, PAHs.

AVGAS
Motor fuels designed for aircraft engines using spark-ignited internal combustion engines. They are mixtures of hydrocarbons that boil in the approximate range of 90–338°F. They have a gravity range of about 66°–72° API.

B

Bias
A systematic error inherent in a method or caused by some feature of the measurement system.

Bioavailability
The individual physical, chemical, and biological interactions that determine the exposure of plants and animals to chemicals associated with soils and sediments.

Biodegradation
A process by which microorganisms transform or alter (through metabolic or enzymatic action) the structure of chemicals introduced into the environment.

Biomarker
A distinct biochemical, genetic, or molecular characteristic or substance that is an indicator of a particular biological condition or process.

BTEX
Benzene, toluene, ethylbenzene, and xylenes, which are volatile aromatics common in the light-range portion of TPH. These chemicals have traditionally been used to evaluate the toxicity of TPH, but over time it has been learned that BTEX is not a robust indicator of TPH toxicity. BTEX is the term used for benzene, toluene, ethylbenzene, and xylene, these are volatile aromatic compounds typically found in petroleum products such as gasoline and diesel fuel.

BTEXN
Targeted individual TPH compounds, BTEX, with the addition of naphthalene, a polycyclic aromatic hydrocarbon with two benzene rings.

C

Carbon chain
A number of carbon atoms bonded together in a sequence and forming part of a molecule, polymer, etc.

Carbon range
The physical properties of a hydrocarbon (such as molecular weight, boiling point, and specific gravity) are correlated with the number of carbon atoms in the molecule. Thus, hydrocarbons of similar molecular weight will have similar properties and may be lumped into a group or range of carbon numbers. If the entire hydrocarbon distribution is divided into appropriate carbon ranges and a model hydrocarbon is selected for each range to describe the average properties of the range, then we can describe the entire hydrocarbon mixture by simply considering the model hydrocarbon from each range.

COCs
Chemicals (or contaminants) of concern.

Colloids
Extremely small soil particles, 0.0001–1 microns in size, that will not settle out of a solution; intermediate between a true dissolved solid and a suspended solid, which will settle out of suspension.

Colorimetric
Describes a quantitative analysis of solutions by estimating their color, e.g., by comparison with the colors of standard solutions.

Column bleed
The degradation of a column due to the continuous change in the column’s properties as the support material is hydrolyzed or the bonded phase material in the column is lost.

Condensate

Hydrocarbons that exist in gaseous form under reservoir conditions, but that condense (become liquid) to a marketable liquid product when brought to the surface, either through natural differences in pressure and temperature or via a production process.

Configurational isomerism

Isomers are chemical compounds with the same chemical formula (that is, the elements are present in the same relative proportions) but that possess different arrangements of the atoms in the molecule and thus different properties. Configurational isomers are compounds that differ in the 3-D relationship of one or more atoms. There is either a difference in the atoms across a bond with restricted rotation (such as a double bond) or across a ring system (cis-trans isomers), or the isomers are mirror images of each other and thus not superimposable (enantiomers).

Creosote

Creosote is the name used for a variety of products: wood creosote, coal tar creosote, coal tar, coal tar pitch, and coal tar pitch volatiles. These products are mixtures of many chemicals created by high-temperature treatment of beech and other woods, coal, or from the resin of the creosote bush.

Csat

The contaminant concentration at which soil pore air and pore water are saturated with the chemical and the adsorptive limits of the soil particles have been reached. Above this concentration, the contaminant may be present in free phase.

Cycloalkane

Consists only of hydrogen and carbon atoms arranged in a structure containing a single ring (possibly with side chains), and all of the carbon-carbon bonds are single.

D

Degradation

Degradation can mean breakdown into small parts or molecules (complete degradation). However, biodegradation is an involved [or “complicated”] process with many steps, in which early step may generate slightly larger, more complex molecules. In this case the “degradation” indicates “transformation.

Depuration

Depuration is the cleansing or purification of chemical or physical contaminants.

Diesel

A petroleum product that contains hydrocarbons with approximately 10–28 carbon atoms. The boiling range is between 170 and 360°C.

Distillation

Distillation is a process of separating the component or substances from a liquid mixture by selective evaporation and condensation. Distillation may result in essentially complete separation (nearly pure components), or it may be a partial separation that increases the concentration of selected components of the mixture. In either case the process exploits differences in the volatility of the mixture’s components. In industrial chemistry, distillation is a unit operation of practically universal importance, but it is a physical separation process and not a chemical reaction.

Diesel range organics (DRO)

Organic chemicals commonly found in diesel range of petroleum products. The portion of purgeable and extractable hydrocarbons in a petroleum product with a boiling point range roughly corresponding to those of diesel fuel (C8–12 to C24–26).

Diesel range petroleum hydrocarbons (TPH-d)

Although more than one definition can be found in the literature, the approximate carbon chain range for TPH-d is C13–C22. Also abbreviated TPH-DRO. See also, “Total petroleum hydrocarbons (TPH).”

E

Effective/equivalent carbon number

The equivalent carbon number (EC) is related to the BP of a chemical normalized to the BP of the n-alkanes or its retention time in a BP GC column. For example, hexane contains six carbons and has a BP of 69oC. Its equivalent carbon number is six. Benzene, also containing six carbons, has a BP of 80oC. Based on benzene's BP and its retention time in a BP GC column, benzene's equivalent carbon number is 6.5.

Effective solubility

The concentration of a chemical in a solution determined by the aqueous solubility of that chemical and the mole fraction of that chemical in the original solution: $C_w = X_o \times S$, where X_o = mole fraction (e.g., of a chemical in a fuel) and S = aqueous solubility of that chemical. For example, the solubility of benzene is around 1,750 mg/L, but typical maximum benzene concentrations resulting from equilibrium between gasoline and water are only 20–40 mg/L. This occurs because the concentration (or effective solubility) depends on the abundance of the chemical in the fuel.

Electron acceptor

A chemical entity that accepts electrons transferred to it from another compound. It is an oxidizing agent that, by virtue of its accepting electrons, is itself reduced in the process.

Emulsified phase

The portion of a petroleum product that is present in water as an emulsion, meaning that it is in the form of a fine dispersion of minute droplets within the water, in which these chemicals are not soluble or miscible.

Emulsion

Two or more liquids that do not dissolve in each other but are held in suspension, one in the other.

Equivalent carbon number

The equivalent carbon number (EC) is related to the BP of a chemical normalized to the BP of the n-alkanes or its retention time in a BP GC column. For example, hexane contains six carbons and has a BP of 69°C. Its equivalent carbon number is six. Benzene, also containing six carbons, has a BP of 80°C. Based on benzene's BP and its retention time in a BP GC column, benzene's equivalent carbon number is 6.5.

Extractable petroleum hydrocarbons (EPH)

Refers to a GC-FID analytical method designed (by the Massachusetts Department of Environmental Protection) to determine the concentrations of petroleum-derived (i.e., originating from crude oil) hydrocarbons in environmental samples. Samples are extracted with methylene chloride. Solvent is exchanged into hexanes, concentrated, and subjected to cleanup and fractionation using silica gel cartridges.

The method defines EPH as "collective" fractions of hydrocarbon compounds eluting from n-nonane to n-hexatriacontane, excluding Target PAH Analytes. EPH consists of C9–C18 aliphatic hydrocarbons, C19–C36 aliphatic hydrocarbons, and C11–C22 aromatic hydrocarbons.

F

Fermentation

The dehydrogenating degradation of organic substances by organisms or cells under anaerobic conditions in which electrons are transferred to metabolites that accumulate and are excreted in reduced form. Fermentation is possible only if the organism is able to gain energy by this process. Complementary terms describing degradation of organic substances are "aerobic respiration" and "anaerobic respiration."

The anaerobic breakdown by microorganisms of complex organic substances, especially carbohydrates, to CO_2 and alcohol.

Flame ionization detector (FID)

Either a field screening device or laboratory analysis device.

Fingerprinting

Analytical method used to identify the source of petroleum contamination, to determine the age (time frame) of a release, and to differentiate petroleum-related contamination and biogenic sources of hydrocarbons (e.g., plants). Examples of analytical methods used for fingerprinting are: ASTM D3328-06 GC/FID: Alkanes & TPH; ASTM D5739-06: MAHs, PAHs, and Alkylated Homologues; Petroleum Biomarkers: Triterpanes, Steranes, Sesquiterpanes,

Alkylcyclohexanes.

Foc

F_{oc} is the fraction of organic carbon in a soil, which is simply its total organic carbon content expressed as a decimal fraction (e.g., 1.0% TOC = 0.010 F_{oc}).

Fractionation

The process of the separation of a mixture of compounds based on their physical properties (e.g., size, polarity, volatility, etc.) using chromatography into more defined parts containing a lower number of chemical compounds.

Fractionation approach

Using the separation of a mixture of compounds based on their physical properties (e.g., size, polarity, volatility, etc.) using chromatography into more defined parts containing a lower number of chemical compounds generally for risk assessment or developing cleanup or screening levels.

Fuel oil

1. A general classification for one of the petroleum fractions produced in conventional distillation operations. It includes diesel fuels and fuel oils. Products known as No. 1, No. 2, and No. 4 diesel fuel are used in on-highway diesel engines, such as those in trucks and automobiles, as well as off-highway engines, such as those in railroad locomotives and agricultural machinery. Products known as No. 1, No. 2, and No. 4 fuel oils are used primarily for space heating and electric power generation.

2. A classification for one of the petroleum fractions produced in conventional distillation operations and from crackers and hydrotreating process units. The generic term “distillate fuel oil” includes kerosene, kerosene-type jet fuel, diesel fuels (diesel fuels No. 1, No. 2, and No. 4), and fuel oils (fuel oils No. 1, No. 2, and No. 4).

G

Gasoline

Any petroleum distillate or petroleum distillate/alcohol blend having a Reid vapor pressure of 27.6 kilopascals or greater that is used as a fuel for internal combustion engines.

Gasoline range organics (GRO)

Organic compounds commonly found in the gasoline range of petroleum products. The portion of purgeable and extractable hydrocarbons in a petroleum product with a BP range roughly corresponding to gasoline (C6 to C10–12).

Gasoline range petroleum hydrocarbons (TPH-g)

Although more than one definition can be found in the literature, the approximate carbon chain range for TPH-g is C4–C12. Also abbreviated TPH-GRO. See also, “Total petroleum hydrocarbons (TPH).”

Gross contamination

Environmental concerns associated with short-term risks (e.g., vapors from temporary excavations; sheens on runoff from stockpiled soil, etc.) and nuisance (e.g., sheens, odors, taste, etc.).

H

Heterocyclics

Relating to, characterized by, or being a ring composed of atoms of more than one kind.

Homolog

A chemical belonging to or consisting of a series whose successive members have a regular difference in composition, especially of one methylene group.

Homologous series

A group of chemical compounds related in composition and structure.

Humic acids

Any of various organic acids obtained from humus (soil, peat, and coal).

Hyporheic zone

A subsurface volume of sediment and porous space adjacent to a stream through which stream water readily exchanges.

I

Isomers

A compound having the same percentage composition and molecular weight as another compound but differing in chemical or physical properties. Isomers may differ in the way constituent atoms are linked or are arranged in space.

Isoparaffins

Branched-chain alkanes.

Isoprenoids

Any of a class of organic compounds composed of two or more units of hydrocarbons, with each unit consisting of five carbon atoms arranged in a specific pattern.

K

Kerosene

A petroleum distillate that boils at a temperature between 149 and 288ºC, has a flash point higher than 38ºC by ASTM Method D 56, has a gravity range between 40 and 46 degrees and has a burning point in the range of 66–79ºC. Included are the two classifications recognized by ASTM Specification D 3699: No. 1-K and No. 2-K, and all grades of kerosene called range or stove oil that have properties like No. 1 fuel oil, but with a gravity of about 43 degrees API and a maximum end point of 329ºC. Kerosene is used in space heaters, cook stoves, and water heaters and is suitable for use as an illuminant when burned in wick lamps.

Koc

A constant that describes a compound's equilibrium condition between organic carbon and the contaminant concentrations in an aqueous solution. Higher K_{oc} values indicate more contaminant mass is likely to be retained in soil and therefore less readily bioavailable.

Kow

A coefficient representing the ratio of the solubility of a compound in octanol (a nonpolar solvent) to its solubility in water (a polar solvent). The higher the K_{ow}, the more nonpolar the compound. Log K_{ow} is generally used as a relative indicator of the tendency of an organic compound to adsorb to soil. Log K_{ow} values are generally inversely related to aqueous solubility and directly proportional to molecular weight.

Ks

The substrate concentration at which growth (u) is occurring at ½ u_m. u_m is the maximum growth rate that can be achieved by the microbe being studied at a defined temperature and for a particular substrate.

L

LC50

The concentration of a material in an environmental medium that causes 50% mortality of a group of test organisms after a certain period of exposure. This measurement end point is most often used in acute laboratory toxicity tests.

LD50

The dose of a toxicant that will kill 50% of test organisms within a designated period of time. The lower the LD 50, the more toxic the compound.

Leaching

Dissolution of contaminants in soil into infiltrating surface water and the generation of leachate, which could under some circumstances migrate to groundwater and cause adverse impacts to drinking water resources or nearby aquatic habitats.

Lead scavenger

Additives in leaded gasoline to prevent buildup of lead oxide deposits within internal combustion engines; includes 1,2-dibromomethane (ethylene dibromide, EDB) and 1,2-dichloroethane (1,2-DCA, ethylene dichloride, EDC).

Lentic system

Lentic system refers to a body of still water such as lakes, ponds or marshes.

Long-term management

Stewardship, maintenance, and/or monitoring to minimize the potential for human exposure to contaminants and to protect the integrity of a cleanup remedy. Used when contamination remains above unrestricted use levels.

M

Mass fraction

The ratio of the mass of one component of a mixture to the mass of the total mixture. Also known as weight fraction; can be expressed as percentage by mass.

Metabolite(s)

Metabolites are organic molecules that are products of biological activity. Most of the naturally occurring dissolved organic carbon in aquatic systems consists of metabolites produced by plants and microorganisms. Thus, some types of metabolites are widespread in the environment. For this ITRC TPH document, we are focusing on petroleum metabolites, which have been assumed to be intermediates within hydrocarbon degradation pathways. These classes of compounds include alcohols, phenols, ketones, aldehydes, and organic acids and esters, or molecules that have combinations of these classes. Recent findings suggest some of the compounds may not be degradation intermediates but are synthesized by microbes growing on petroleum-derived carbon. Because metabolites have oxygen(s) in the molecule, they are “polar” in chemical structure and thus are more soluble than the parent hydrocarbons. They are sometimes referred to as “polar metabolites.” Methane is not included in this definition and is treated separately because although it is produced by an anaerobic microbial process it does not include an oxygen and is a terminal (end-stage) molecule that is produced along with carbon dioxide.

Method detection limit (MDL)

The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Middle distillate (Mid-distillate)

Petroleum mixtures characterized by a wider variety of straight, branched, and cyclic alkanes, as well as polycyclic aromatic hydrocarbons and heterocyclic compounds with 372 carbon ranges of approximately C9–C25.

Motor oil range petroleum hydrocarbons (TPH-mo)

Although more than one definition can be found in the literature, the approximate carbon chain range for TPH-mo is C23 to >C40. See also, “Total petroleum hydrocarbons (TPH).”

N

Naphthenes

Naphthenes (also called cycloalkenes) are types of hydrocarbon compounds that have one or more rings of carbon atoms in the chemical structure of their molecules.

Naphthenic acids

Naphthenic acids (CAS: 1338-24-5) is the name for an unspecific mixture of several cyclopentyl and cyclohexyl carboxylic acids with molecular weight of 120 to well over 700 atomic mass units. The main fraction are carboxylic acids with a carbon backbone of 9–20 carbons.

Narcosis

A reversible state of central nervous system depression induced by a drug or other chemical.

Narcosis target lipid model

The narcosis target lipid model was developed to predict the chemical toxicity to aquatic organisms via narcosis, and is based on the hypothesis that target lipid is the site of toxic action within the organism, that octanol is the appropriate surrogate, and that target lipid has the same physical-chemical properties in all organisms.

National Pollutant Discharge Elimination System (NPDES)

A provision of the Clean Water Act that prohibits discharge of pollutants into waters of the United States unless a

special permit is issued by the EPA, a state, or a tribal government on a reservation.

Nonpolar

A molecule may be nonpolar either when there is an equal sharing of electrons between the two atoms of a diatomic molecule or because of the symmetrical arrangement of polar bonds in a more complex molecule.

Nuisance

A general term used by some agencies to describe petroleum-contaminated soil and water that emits a noticeable odor, or in the case of drinking water, both taste and odors. Screening levels based on nuisance concerns have a similar but less well-defined intent to those published for “gross contamination.”

O

Oil Pollution Act of 1990 (OPA)

OPA, along with the CWA and CERCLA, mandates that parties that release hazardous materials and oil into the environment are responsible not only for the cost of cleaning up the release, but also for restoring any injury to natural resources that results.

Oil range petroleum hydrocarbons (TPH-o)

See also, “Total petroleum hydrocarbons (TPH),” and “Motor oil range petroleum hydrocarbons (TPH-mo).”

Olefins

Olefins (also called alkenes) are compounds made up of hydrogen and carbon that contain one or more pairs of carbon atoms linked by a double bond.

Oxygenated compounds

Compounds that contain oxygen as part of their chemical structure. Often refers to oxygenated fuels and the additives used to reduce carbon monoxide emissions during the burning of fuel.

Oxidation-reduction (Redox)

A chemical reaction consisting of two half-reactions—an oxidation reaction in which a substance loses or donates electrons, and a reduction reaction in which a substance gains or accepts electrons. Redox reactions are always coupled because free electrons cannot exist in solution and electrons must be conserved.

P

PAH

Polyaromatic hydrocarbon: Aromatic hydrocarbons containing more than one fused benzene ring.

Polycyclic aromatic hydrocarbons: Aromatic compounds of specific structures that are commonly found in petroleum products. For example, naphthalene, benzo(a)pyrene.

Paraffins

The historical term for alkanes. A flammable, whitish, translucent, waxy solid consisting of a mixture of saturated hydrocarbons, obtained by distillation from petroleum or shale.

Partial transformation product (PTP)

Organic molecules containing oxygen that are intermediates in the metabolic pathway of the aerobic or anaerobic microbial oxidation (transformation) from hydrocarbon to complete mineralization as carbon dioxide and water. They are also referred to as partial oxidation products. These are alcohols, phenols, ketones, aldehydes, and organic acids and esters. Methane is not included as a PTP because it is a terminal (end-stage) molecule produced along with carbon dioxide. Synonymous with “metabolites.”

Partition, partitioning

Separation or migration into different phases (solid, liquid, gas), i.e., volatile hydrocarbons in soil or groundwater migrate through the vadose zone to receptors. Also used in reference to organic carbon partition fraction, which is the theoretical ratio of the mass absorbed to soil particles versus dissolved in pore water, and octanol-water partition coefficient, which is the ratio of a chemical concentration in 1-octanol (C_o) and water (C_w) in an octanol-water system that has reached a chemical equilibrium.

Petroleum

Crude oil or any fraction thereof that is liquid under normal conditions of temperature and pressure. The term includes petroleum-based substances consisting of a complex blend of hydrocarbons derived from crude oil through the process of separation, conversion, upgrading, and finishing, such as motor fuel, jet oil, lubricants, petroleum solvents, and used oil.

Photooxidation

Oxidation caused by exposure to light.

Polar compound(s)

Organic molecules that have an atom or functional group that contains atoms in addition to hydrogen and carbon. The atom that is not hydrogen or carbon is called a heteroatom. Related to petroleum sources, the most common heteroatoms are nitrogen, sulfur, and oxygen. Thus, all metabolites are polars, but not all polars are metabolites.

Polarity

A separation of electric charge leading to a molecule or its chemical groups having an electric dipole or multipole moment.

Polycyclic aromatic hydrocarbons

A class of organic compounds with a fused-ring aromatic structure. For example, naphthalene, benzo(a)pyrene.

Polynuclear aromatic hydrocarbons

A subset of polycyclic aromatic hydrocarbons that have fused aromatic rings.

Provisional Peer-Reviewed Toxicity Values (PPRTV)

A toxicity value derived for use in the Superfund Program when such value is not available in EPA's Integrated Risk Information System (IRIS). It is derived after a review of relevant scientific literature using methods, sources of data, and guidance for value derivation used by the EPA IRIS program.

Purge, purgeable

Extraction of volatile organic compounds and surrogates from the sample matrix by bubbling an inert gas through the aqueous sample. Purged sample components are trapped in a tube containing suitable sorbent materials.

Pyrogenic

Caused or produced by combustion or the application of heat.

Q

Quantitative polymerase chain reaction (qPCR)

A laboratory analytical technique for identification of a target gene (DNA) or quantitation of an expressed gene (RNA) that can be used to identify organisms or enzymes.

Quantitation method

A procedure that uses chromatographic data to determine the amount of a given component in a mixture. This data can be in the form of either peak height or peak area, which is obtained from an integrated chromatogram. The five most common quantitation methods are area percent, single point external standard, multiple point external standard, single point internal standard, and multiple point internal standard.

Quantitative Structure-Activity Relationship (QSAR)

A mathematical relationship between a quantifiable aspect of chemical structure and a chemical property or reactivity or a well-defined biological activity, such as toxicity. Using a sample set of chemicals, a relationship is established between one or many physical-chemical properties a chemical possesses due to its structure and a chemical property or biological activity of concern. This mathematical expression is then used to predict the chemical properties or biological chemical structures that have similar properties, biological activities, or toxicity potential.

R

Risk Assessment Guidance for Superfund (RAGS)

An EPA guidance for conducting baseline risk assessment, developing risk-based preliminary goals, site-specific risk

evaluations, and human health risk evaluation.

Raoult's law

A law of thermodynamics that states that the partial vapor pressure of each component of an ideal mixture of liquids is equal to the vapor pressure of the pure component multiplied by its mole fraction in the mixture.

Reduction

Reduction of a chemical compound occurs when electrons are transferred to that compound.

Reporting limit

The minimum value of the calibration range. Analyte detections between the detection limit and the reporting limit are reported as having estimated concentrations.

Reporting limit (RL)

The lowest concentration of analyte in a sample that can be reported with a defined, reproducible level of certainty. Reporting limits can be set by laboratory staff according to what they feel comfortable reporting in a legal framework. They can also be specified by a client when using a contract laboratory. Many states have guidance on reporting limits.

Residual oil

Oil held by capillary forces in the narrowest section of the soil pore space, typically where water is the wetting fluid and air is the nonwetting fluid. Because an oil at residual saturation is not connected across the network of pores, the oil is not capable of flow. It is discontinuous and can be immobilized by capillary forces.

Residual range organics (RRO)

Hydrocarbons with physical properties (such as molecular weight, BP, and specific gravity) like that of residual fluid. Typical carbon range is C25–C36 (25–36 carbons).

Risk assessment

The process of defining and analyzing the dangers to human health and ecology as well as other risks associated with a remediation project. Once they are quantified, it is easy to compare with existing action levels, and appropriate actions can be conducted to manage the risk.

Risk Assessment Information System (RAIS)

An EPA web-based system used to disseminate risk tools and supply information for risk assessment activities.

Risk-based corrective action (RBCA)

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.

Risk screening level (RSL)

RSLs are risk-based concentrations derived from standardized equations combining exposure information assumptions with USEPA toxicity data. They are considered by the agency to be protective for humans (including sensitive groups) over a lifetime. They are calculated without site-specific information. They may be recalculated using site-specific data.

Route of exposure (aka exposure route)

The way that a human or ecological receptor comes into contact with a chemical. In environmental contexts, most commonly ingestion (oral), inhalation, or dermal, or for aquatic organisms, direct contact.

S

Safe Drinking Water Act (SDWA)

The 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 USEPA 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 USEPA also encourage attainment of secondary (nuisance-related) standards.

Saturated

(1) A molecule that has only single bonds (i.e., no double or triple bonds), such as octane (C_8H_{18}), which is a straight-chain hydrocarbon saturated with hydrogen.

(2) A solution containing the maximum possible amount of a solute at a given temperature. The solution is in equilibrium with the undissolved solute.

Semivolatile organic compounds (SVOCs)

SVOCs, composed primarily of carbon and hydrogen atoms, have BPs greater than 200°C. Common SVOCs include phenols and phthalates.

Signal-to-noise ratio

The height of the signal as measured from the mean (average) of the noise to the peak maximum divided by the amplitude of the noise. In GC analysis, diesel oil is not present in the sample if there are less than 10 n-alkane peaks present in the C9–C24 range at a signal-to-noise ratio equal to or greater than 3 for each peak.

Silica gel cleanup (SGC)

Silica gel cleanup may be used for the removal of residual, unwanted polar molecules present in a sample of mostly nonpolar compounds extracted with a nonpolar solvent such as hexane. The more polar molecules stick to the silica gel (hydrated SiO2) while the nonpolar compounds move with the solvent, which is collected for GC analysis.

Secondary ion mass spectrometry (SIM)

SIM allows the mass spectrometer to detect specific compounds with very high sensitivity. In this technique, a single ion is monitored at a time, permitting one class of compound to be separated and analyzed apart from all others.

Sour

Refers to the sulfur content of crude oil. Sour crude oil will have greater than 0.5% sulfur, and some of this will be in the form of hydrogen sulfide.

Source zone

The subsurface zone containing a contaminant reservoir sustaining a plume in groundwater or soil vapor. Source zone mass can include sorbed and aqueous-phase contaminant mass as well as NAPL.

Surrogate

A nontarget analyte that has similar chemical properties to the analyte of interest. The surrogate standard is added to the sample in a known amount and used to evaluate the response of the analyte to preparation and analysis procedures.

T

Target lipid model (TLM)

A TLM can assess the toxicity of type I narcotic chemicals.

Total petroleum hydrocarbons (TPH)

(1) The known or assumed aliphatic and aromatic hydrocarbon mixture (e.g., crude oil, fuel type, mixture of fuel types) originally released to the environment, or the remaining aliphatic and aromatic hydrocarbon mixture after weathering thereof, for LNAPL, soil, and sediment sample matrices.

(2) The dissolved hydrocarbons that have partitioned from the hydrocarbon mixture into groundwater or surface water for the water matrix.

(3) The volatilized hydrocarbons that have partitioned from the hydrocarbon mixture or the dissolved phase to the soil vapor for the air matrix.

TPH is defined by the aliphatic and aromatic hydrocarbon carbon range fractions covering the applicable carbon range based on the known or assumed original hydrocarbon mixture (or the weathered hydrocarbon mixture thereof), or the hydrocarbon fractions partitioned to water or air. In the case of uncertainty regarding what

petroleum type was released to the environment, the aliphatic and aromatic carbon ranges should cover the entire potential range (e.g., EC5–EC35 for aliphatics, and EC8–EC35 for aromatics).

Toxic unit (TU)

A measure of toxicity in an effluent as determined by the acute toxicity units or chronic toxicity units. Higher TUs indicate greater toxicity.

Toxicity reference value (TRV)
A reference point (generally a dose or concentration) where exposures below that point are not likely to result in an adverse event/effect given a specific range of time.

Turbidity
The cloudy appearance of water caused by the presence of suspended and colloidal matter. Turbidity indicates the clarity of water and is an optical property of the water based on the amount of light reflected by suspended particles.

U

Unresolved complex mixture (UCM)
A term used to describe a gas chromatogram indicative of the presence of fossil fuel hydrocarbons (mainly petroleum hydrocarbons) in hydrocarbons isolated from aquatic samples.

The thousands of compounds that a gas chromatograph mixture is unable to fully separate.

V

Visbreaking
A chemical engineering process unit used in petroleum refineries that reduces the viscosity of the residual oil from the refinery's atmospheric or vacuum distillation of petroleum crude oil and increases the yield of more valuable middle distillates (fuel oils) by the refinery.

A process for reducing the viscosity of heavy feedstocks by controlled thermal decomposition.

Volatile petroleum hydrocarbons (VPH)
All hydrocarbon compounds eluting just prior to n-pentane through 1-methylnaphthalene.

W

Water-accommodated fraction (WAF)
A laboratory-prepared medium derived from low-energy (no vortex) mixing of a poorly soluble test material (e.g., an oil or petroleum product) that is essentially free of particles of bulk material (Aurand and Coelho 1996; Coelho and Aurand 1997).

A preparation method where oil is placed over a volume of seawater and mixed with a magnetic stirrer, generally for 18–24 hours. The amount of mixing energy may vary, but is typically adjusted such that visible oil droplets do not become entrained in the seawater. The mixing period is then followed by a "resting" period that allows larger oil droplets to rise to the surface. The test media are removed via a port at the bottom of the mixing container.