GLOSSARY

Acute exposure: Exposure to elevated concentrations over a relatively short period of time.

Advection/advective flow: Bulk transport of the mass of discrete chemical or biological constituents by fluid flow within a receiving water. Advection describes the mass transport due to the velocity, or flow, of the water body. It is also defined as the process of transfer of fluids (vapors or liquid) through a geologic formation in response to a pressure gradient that may be caused by changes in barometric pressure, water table levels, wind fluctuations, or infiltration. It is transport of solute by the bulk motion of flowing groundwater.

Aerobic: Pertaining to, caused by, or characterized by the presence of oxygen.

Air dispersion modeling: The use of mathematical formulations to characterize air pollutant dispersion processes.

Air exchange rate (AER): The rate at which outdoor air enters a structure, exchanging with the indoor air.

Aliphatic: A hydrocarbon compound in which the carbon atoms are in a straight-chain, branched, or cyclic arrangement and are saturated or unsaturated.

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

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

Air sample: Collection of air taken from the surrounding environment (indoor or outdoor) to assess its composition. This type of sample typically measures the presence and concentration of pollutants, gases, particles, or other substances in the air. It is a critical tool for monitoring air quality, studying environmental conditions, and ensuring compliance with health and safety standards. These samples are often collected using specialized equipment.

Anaerobic: Pertaining to, caused by, or characterized by the absence of oxygen.

ANSI/AARST standards: National consensus practices used by federal and state agencies.

Aquifer: A body of permeable rock that can contain or transmit groundwater.

Aromatic: An organic compound that contains one or more benzene or equivalent heterocyclic rings.

Attenuation factor (AF): A ratio of the indoor air concentration to soil vapor or groundwater concentration; it is sometimes used to estimate the indoor air concentration from soil vapor or groundwater concentration.

Back drafting: The reverse flow of gas in the flues of fuel-fired appliances that results in the intrusion of combustion byproducts into the living space.

Background sources: Indoor or outdoor air concentrations of vapor-forming chemicals that are present in the absence of a release to the environment or in the absence of a complete vapor intrusion pathway.

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

Building envelope: The physical boundary between the conditioned and unconditioned environment of a structure, including the resistance to air and water transmission.

Building foundation: The base of the structure that is in direct contact with the ground. It provides structural support and provides stability. It can include concrete slabs, crawl spaces, basements, and various types of footings.

Building pressurization: The air pressure within a structure relative to the air pressure outside.

Capillary fringe / capillary zone: The pore spaces in soil just above the water table that may contain water above the static level from interactive forces between the water and soil.

Chemicals (or contaminants or constituents) of concern (COCs): Compounds derived from hazardous substances that are subject to evaluation for the purposes of applying risk-based corrective action decision-making. This is typically a smaller subset of chemicals from the list of chemicals of potential concern.

Chemicals (or contaminants or constituents) of potential concern (COPCs): Substances identified during environmental assessments as possibly posing risks to human health, ecosystems, or property, requiring further analysis to narrow down from a broad list to a "short list" of primary risk-driving chemicals.

Chlorinated vapor intrusion: Volatile chlorinated chemicals, typically originating from contaminated soil or groundwater, that migrate as vapors into overlying structures through cracks, gaps, or openings in the foundation.

Chronic exposure: Exposure to a low-level concentration over a long period of time.

C_{IA}: Measurements of vapor-forming chemical concentrations in indoor air.

Clean soil: Soil with an acceptable level of contamination that remains conducive to biodegradation of petroleum vapors.

Vapor intrusion closure/ unrestricted vapor intrusion closure: Closure due to the elimination of complete or potentially complete vapor intrusion pathways for a site such that vapor-forming chemicals are below applicable levels and no mitigation measures or institutional controls are required to protect current or future structure receptors.

Coal tar: A brown or black liquid of extremely high viscosity. Coal tar is one of the resultant byproducts when coal is carbonized to make coke or gasified to make coal gas. Coal tars are complex and variable mixtures of phenols, polycyclic aromatic hydrocarbons, and heterocyclic compounds. A byproduct of the pyrolysis of coal, coke, or oil in a closed vessel during the production of manufactured gas containing a small percentage of volatile organics and polycyclic aromatic hydrocarbons.

Community engagement: The process of communicating with local residents and other stakeholders to provide information throughout the investigation and cleanup of a contaminated site, providing opportunities for offering input about site investigation/cleanup plans, and facilitating the resolution of community issues related to a contaminated site.

Concentration gradient: The change of concentration over a certain distance.

Conceptual site model (CSM): (1) A three-dimensional representation of an environmental system and the biological, physical, and chemical processes that determine the transport and fate of contaminants through environmental media to environmental receptors and their most likely exposure modes. (2) A vapor intrusion CSM is a hypothesis about how contaminant releases occurred, the current state of the source zone, and current plume characteristics (plume stability). (3) A living collection of information about a site that considers factors such as environmental and land use plans, site-specific chemical and geologic conditions, and the regulatory environment. (4) An iterative representation of the site that summarizes and helps project planners visualize and understand available information. The vapor intrusion CSM is the primary planning and decision-making tool used to identify the key issues and the data necessary to transition a project from characterization through post-remedy. (5) Describes the potential chemical sources, release mechanisms, fate and transport pathways, impacted environmental media, receptors, and exposure pathways for current and reasonably anticipated future activities and land uses. This model documents current site conditions and serves to conceptualize the relationship among chemicals in environmental media, sources, and receptors through consideration of potential or actual migration and exposure pathways.

Conduit vapor intrusion preferential pathway (conduit VIPP): Conduit VIPPs are outside, or extend outside, of the building footprint and enhance transport toward the structure, such as sanitary sewers, utility tunnels or other pipes, and karst geology. These features essentially connect distal subsurface vapor-forming chemical sources to the structure itself. The vapor-forming chemical flux is through the interior of the conduit (see vapor intrusion preferential pathway).

Confining unit / aquitard: A layer of rock or soil of very low hydraulic conductivity that hampers the movement of groundwater in and out of an aquifer.

Construction quality assurance plan (CQA plan): A formal document outlining the processes, procedures, and activities required to ensure that a construction project meets specified quality standards. This plan typically includes guidelines for monitoring and testing materials, workmanship, and compliance with design specifications. It also identifies roles and responsibilities, inspection protocols, documentation requirements, and corrective action measures.

Coupon testing: A specimen of an installed material collected for testing or verification.

Cyclic: A compound that contains a closed ring of atoms.

Daughter products / degradation products: Substances formed when a chemical compound breaks down or undergoes a transformation due to physical, chemical, or biological processes. This breakdown can occur naturally (e.g., from sunlight, water, or microbial activity) or as a result of human activities.

Dense nonaqueous-phase liquid (DNAPL): A water-immiscible organic liquid that is denser than water (such as tetrachloroethene).

Depressurization: To remove the air pressure from.

D_{eff}: The effective diffusion coefficient of vadose-zone soil.

Diffusion: (1) Movement of vapors away from areas of higher concentration. (2) The process of net transport of solute molecules from a region of high concentration to a region of low concentration caused by their molecular motion in the absence of turbulent mixing.

Discharge criteria: Generic term used to describe emission regulatory limits.

Emergency response: Explosive conditions between the upper explosive limit and lower explosive limit that warrant mitigation by emergency responders.

Emission controls: Means employed to limit the discharge of gases.

Engineering controls (ECs): The methods or strategies that involve using technology or making physical changes to the structure or structure systems to reduce concentrations of vapor intrusion contaminants to acceptable levels or as low as practicable if still above acceptable long-term levels.

Expansion joints: An assembly designed to hold parts together while safely absorbing expansion and contraction.

Fick's law: The principle that diffusive flux goes from areas of high concentration to areas of lower concentration with a magnitude proportional to the concentration gradient.

Floor drain: A plumbing fixture that is installed in the floor of a structure designed to remove any standing water near it.

Flow velocity: Vector field that is used to describe fluid motion in a mathematical manner.

Flux: (1) Flow per unit area. (2) Rate of flow of fluid, particles, or energy through a given surface. (3) The mass (mass flux) or volume (flux) moving through an area per time.

French drain: A trench filled with gravel or rock or containing a perforated pipe that redirects surface water.

Gasolines: Petroleum mixtures characterized by a predominance of branched alkanes with carbon ranges from C3 to C12 and lesser amounts of aromatics, straight-chain alkanes, cycloalkanes, and alkenes of the same carbon range.

Heating, ventilation, and air conditioning (HVAC): The technology of indoor and vehicular environmental comfort, including heating, cooling, and air movement.

Heavy metal: A group of elements characterized by their high atomic weights, densities, or numbers. These metals include but are not limited to lead, mercury, cadmium, and chromium, and they possess distinctive properties such as toxicity and corrosion resistance.

Henry's Law: The principle that the amount of a gas dissolved at equilibrium in a certain quantity of liquid is proportional to the pressure of the gas in contact with the liquid.

Heterocyclic: A compound that contains a closed ring of atoms in which one of the ring members is not a carbon atom.

Human exposure pathway: Refers to the way a person can come into contact with a hazardous substance.

Indicator compound: A compound chosen for its likely presence in an area of interest that is used to estimate conditions as a whole for the area of interest.

Indoor air sample: A collection of air from within a structure or enclosed space to evaluate its quality and composition. These samples help identify the presence and concentration of contaminants such as vapor-forming chemicals or other pollutants. Indoor air sampling is crucial for assessing health risks, ensuring compliance with safety standards, and determining the effectiveness of air filtration or ventilation systems.

Inorganic compounds: Substance in which two or more chemical elements (usually other than carbon) are combined.

Institutional control (IC): A form of land use controls that provides protection from exposure to site-related contaminants.

Interior transport pathway: Enhanced airflow within a given structure.

Intrinsically safe: Lacking the energy necessary to cause ignition.

Johnson & Ettinger model (J&E model): A one-dimensional analytical solution to convective and diffusive vapor transport into indoor spaces. The model provides an estimated attenuation coefficient that relates the vapor concentration in the indoor space to the vapor concentration at the source of contamination.

Laser screed: A self-leveling head that is mounted on a telescopic boom used to smooth and level concrete.

Lateral inclusion zone / lateral screening distance: The zone of potential influence in which a source can impact surrounding receptors.

Light nonaqueous-phase liquid (LNAPL): A liquid that is not soluble and has a lower density than water.

Long-term stewardship: Activities implemented for the management of contaminated environmental media that are necessary to protect human health and the environment over time.

Lower explosive limit (LEL): The minimum concentration of a gas or vapor in the air that is capable of producing a flash or fire in the presence of an ignition source.

Managed vapor intrusion closure / restricted vapor intrusion closure: Strategies to achieve regulatory closure (jurisdictionally defined) while a need for a vapor intrusion mitigation system, structure modification(s), ongoing monitoring/ reporting, and/or institutional control remains.

Mass discharge: This is an integrated mass flux estimate (i.e., the sum of all mass flux measures across an entire plume); thus, it represents the total mass of any solute conveyed by groundwater through a defined plane. Mass discharge is therefore expressed as mass/time (e.g., g/d).

Mass flux: This is a rate measurement specific to a defined area, which is usually a subset of a plume cross section. Mass flux is thus expressed as mass/time/area (e.g., g•d-1•m-2).

Methanogenic: Able to produce methane from a limited number of substrates.

Middle distillates: 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 to C25.

Mitigation: Generally applied to actions that prevent or limit human exposure to vapor-forming chemicals.

Mitigation strategy: An approach used to reduce the severity of something, such as vapor intrusion.

Modeling: The use of computational tools and methods to simulate how chemical vapors, often from contaminated soil or groundwater, migrate into structures. These models help predict the behavior and concentration of hazardous vapors, such as chlorinated solvents or vapor-forming chemicals, as they travel through subsurface pathways like soil pores, cracks, or gaps in structure foundations.

Multiphase extraction (MPE): This is an environmental remediation technique used to remove contaminants from both soil and groundwater. This method is particularly effective for sites contaminated with petroleum hydrocarbons or chlorinated solvents. It involves the simultaneous extraction of multiple phases: the liquid phase (e.g., groundwater or free product like oil), the gas phase (e.g., volatile organic compounds in the air), and the solid phase (e.g., contaminants trapped in soil pores).

Natural draft: The use of natural atmospheric pressure to force gases of combustion out through a ventilation system.

Operation, maintenance, and monitoring (OM&M) plan: Refers to the routine inspection, servicing, and repairing or replacing of necessary equipment of an operating system.

Organic carbon partition coefficient: The theoretical ratio of the mass absorbed to soil particles versus the mass dissolved in pore water.

Organic vapor analysis: Tools that qualitatively measure organic vapors, such as a photoionization detector.

Outdoor air sample: A collection of air from the outdoor environment to assess its quality and composition. These samples are commonly used to monitor pollutants such as vapor-forming chemicals or other pollutants. They help evaluate the impact of natural and human activities on air quality, track regulatory compliance, and identify health or environmental risks.

Oxygen sink: A process (such as biodegradation) that reduces the amount of oxygen present.

Pathways: The process in which any chemical that can induce an adverse response may come in contact with receptors.

Perched aquifer: A water-saturated zone that is above or not directly connected to the regional aquifer; a perched aquifer may develop when saturated conditions are present above a low-permeability layer.

Petroleum industrial site / non-underground storage tank (UST) site: A source area where underground storage and aboveground storage tanks are not used.

Petroleum underground storage tank (UST) /aboveground storage tank (AST) site: A source area where underground storage and/or aboveground storage tanks are used.

Petroleum vapor intrusion (PVI): The process by which volatile hydrocarbons partition from petroleum-contaminated soils and/or groundwater and migrate through the vadose zone in gaseous form to receptors.

Phase partitioning: Separation of fuel into solid, liquid, and gas phases.

Phreatic (saturated) zone: The part of an aquifer, below the water table, in which all pores and fractures are essentially saturated with water.

Plenum: Continuous void space under the slab that can facilitate air circulation.

Post-installation verification: A testing procedure used to show that something is functioning properly after an initial installation or an upgrade.

Precluding factors: Elements that make a selected approach impossible by necessary consequence.

Preferential pathway: A generic, umbrella term encompassing both (1) natural and manmade features that enhance the migration of vapor-forming chemicals into a structure relative to migration through bulk soil and (2) general vapor entry points at the building envelope (e.g., foundation cracks, drains, expansion joints). In this document, we distinguish the features by referring to the former as conduit or vertical vapor intrusion preferential pathways and the latter as vapor entry points.

Preliminary conceptual site model (CSM): The first iterations of a conceptual site model used in the preliminary stages of site characterization.

Pressure field extension (PFE): An area beneath a concrete slab or foundation where a sufficient amount of negative pressure (vacuum) has been obtained.

Q_{BPC}: Airflow rates across a blower door associated with indoor air depressurization.

$Q_{building}$: The volumetric airflow of soil vapor within and out of a structure.

Q_{soil}: The volumetric airflow of soil vapor from the subsurface to indoor air.

Q_{SSG}: Measurements of vapor-forming chemical concentrations and airflow rates associated with sub-slab soil vapor depressurization.

Raoult's law: The principle that the vapor pressure of an ideal solution is directly dependent upon the vapor pressure of each chemical component and mole fraction of each component in the solution.

Rapid response / initial hazard abatement: An interim vapor intrusion mitigation approach that may be appropriate, under certain conditions (e.g., high contaminant concentrations and sensitive populations present), prior to implementing a long-term mitigation strategy for an occupied room or structure.

Reasonable maximum exposure (RME): the highest exposure that is reasonably expected to occur at a site, which in practice is estimated by combining upper bound (90–95 percentile) values for some but not all exposure parameters with the 95 percent upper confidence limit of the arithmetic mean for the chemical concentration.

Receptors: A vulnerable area of concern where members of the public or biologics could be exposed to toxic concentrations as the result of a release.

Redox potential: Chemical reduction-oxidation processes and conditions that can result in the alteration of a chemical compound.

Remediation/remedy: An action or set of actions that reduce the level of contamination or eliminate the source in the environmental medium (e.g., soil, groundwater) that is acting as the source of the vapor-forming chemicals in indoor air.

Residual fuels: Petroleum mixtures characterized by complex, polar polycyclic aromatic hydrocarbons and other high molecular weight hydrocarbon compounds with carbon ranges that generally fall between C24 and C40.

Response action: A specific activity or set of activities undertaken to investigate, assess, and ultimately address the potential or actual human exposure to hazardous chemical vapors that have migrated from a subsurface source (contaminated soil or groundwater) into the indoor air of structures.

Risk assessment: A series of analytical methods that characterize the probability, nature, and magnitude of risks to human health for various populations.

Risk communication: Actions, words, and other messages, responsive to the concerns and values of the information recipients, intended to help people make more informed decisions about threats to their health and safety. Risk communication is the formal and informal process of communication among and between regulatory agencies and organizations responsible for site assessment and management and the various parties who are potentially at risk from or are otherwise interested in the site.

Risk management: The process of deciding whether and how to manage risks to human health and the environment.

Sensitivity: A relative measure of the effect a model input parameter, such as soil porosity, soil moisture, or soil fraction of organic carbon, has on the model output, such as indoor air concentration or risk.

Site: The area(s) defined by the extent of migration of the vapor-forming chemicals, regardless of specific property boundaries.

Slab/structure slab: "Slab," in the context of vapor intrusion, is the structure/subsurface interface through which vapors can migrate.

Smoke pen: A handheld device that creates a puff or a trail of white smoke used to identify leaks or air flow direction.

Smoke testing / tracer gas testing: A nondestructive testing method that uses a nontoxic smoke or tracer gas to evaluate a system component.

Soil gas / soil vapor: The mixture of gases found in the small spaces (pores) between soil particles. These gases can originate from natural sources, such as microbial activity, or from human activities, like industrial spills or the use of underground storage tanks. Soil gas often includes components such as oxygen, carbon dioxide, nitrogen, methane, or vapor-forming chemicals.

Soil pore space: The air- or water-filled space that is between soil particles.

Soil vapor extraction (SVE): An environmental remediation technique used to remove volatile contaminants, like petroleum hydrocarbons or solvents, from soil. This method works by extracting vapors from the subsurface using wells or pipes installed in the contaminated area.

Sources: A location of the discharge of toxic substances and/or pollutants to environmental media.

Spatiotemporal: Having both spatial and temporal qualities.

Stack effect: Process in which warm air rises, causing negative pressure on a structure interior applied to the surface of the floor slab, resulting in a pressure differential that can exacerbate vapor intrusion.

Stakeholder: Affected tribal members, community members, members of environmental and community advocacy groups, and local governments.

Structure: On- or off-site residences; institutions (e.g., schools, hospitals); industrial, commercial, and office buildings; parks; or recreational areas inhabited or occupied by the public at any time without restriction and that are used for residential or industrial purposes on a regular basis.

Surrogates: Variables with a quantitative relationship to the target compound for a study sufficient to be useful as a substitute for directly measuring the target compounds.

Telemetry: Process of recording and transmitting the readings of an instrument.

Tortuosity: The ratio of the diffusivity in free space to the diffusivity in the porous medium.

Total petroleum hydrocarbons (TPHs): The sum total of all compounds composed of hydrogen and carbon in petroleum including all aliphatic and aromatic components.

Tracer: Substances that migrate similarly to the vapor-forming chemicals of interest for vapor intrusion.

Uncertainty: A model user's or site assessor's lack of knowledge of the true physical site parameters values, such as soil porosity, soil moisture, or soil fraction of organic carbon, that have an effect on the fate and transport of vapor-forming chemicals in the subsurface.

Upper explosive limit (UEL): The maximum concentration of a gas or vapor in the atmosphere that can ignite and cause a flash or fire in the presence of an ignition source.

Utilidor / utility tunnel / utility corridor: A passage used for routing utility lines, such as electric lines, water supply pipes, sewer pipes, and communications lines.

Vadose zone: The unsaturated zone of soil in which the pore space is filled with both air and water.

Vapor control technologies: Technologies employed to mitigate real or potential impacts from vapor intrusion.

Vapor entry point: Penetrations through the structure foundation such as cracks, expansion joints, and plumbing (e.g., defective plumbing or dry p-traps) that can enhance airflow through the foundation.

Vapor intrusion (VI): The process by which volatile vapors partition from contaminated groundwater or other subsurface sources and migrate upward through vadose-zone soils and into overlying structures.

Vapor intrusion component: The part of the overall site assessment or investigation that covers vapor-forming chemicals (VFCs) from a release, transport and migration of a complete or potentially complete pathway, and a current/future structure receptor. Sites with no current potential for subsurface VFCs or sites where subsurface VFCs are present but current or future complete pathways have been ruled out would not have a vapor intrusion component.

Vapor intrusion mitigation: A method, technology, control, or combination thereof used to prevent or reduce the severity of vapor intrusion.

Vapor intrusion mitigation system (VIMS): A group of interconnected parts or elements designed to prevent or reduce the severity of vapor intrusion specifically at a structure.

Vapor intrusion preferential pathway (VIPP): A pathway that intersects both the vapor source and the structure foundation and provides for an increased flow of vapors that is more than expected under typical conditions (i.e., a typical vapor transport through vadose-zone soils). Conduit VIPP and vertical VIPP are specific scenarios resulting in a vapor intrusion preferential pathway.

Vapor plume: The lateral and vertical extent of vapor-forming chemicals within the subsurface.

Vapor-forming chemicals (VFCs): Chemical compounds that readily volatilize to produce vapors.

Vent riser: Vertical exhaust piping connected to a horizontal vent system for passive or active mitigation.

Vent stack: A pipe placed vertically or nearly vertical for ventilation.

Vertical screening distance: The minimum distance in soil between a petroleum vapor source and structure foundation needed to effectively biodegrade hydrocarbons below a level of concern for petroleum vapor intrusion.

Vertical separation distance: The vertical distance from a petroleum vapor source to a structure foundation. The thickness of clean, biologically active soil between a contaminant mass and the lowest point of an overlying receptor.

Vertical vapor intrusion preferential pathway (vertical VIPP): Vertical VIPPs are within the structure footprint and generally enhance vertical transport into the structure that may not have happened under typical construction or operating conditions. Vertical VIPPs include features such as elevator sumps and dry wells (see vapor intrusion preferential pathway).

Volatile organic compounds (VOCs): A variety of chemicals, some of which may have short- and long-term adverse health effects, that are prone to evaporation at ambient temperatures.

This portion of the page left blank intentionally. Acronyms begin on the following page.